DECEMBER 1958—AUTOMOTIVE PRODUCTION NUMBER

Machinery

Production with Tool Room Accuracy
Increases Demand for the HARDINGE HCT Precision Chucking Machine

Photograph Courtesy of
General Machine & Instrument Co.
Caldwell Township, N. J.

For HARDINGE Tool Room Lathes, see Page 90

it's mainly a matter of TIMING!

When an old machine costs you more than it earns, replacement pays for itself!

There comes a time in the life of any machine, when it will no longer produce at a profit — a time beyond which its continued use represents a *financial loss* to your company. This point of obsolescence may be the result of physical aging or of technological advances. In either case, the result is the same — money wasted that could be *saved* by the investment in a new machine.

Determining *when* to replace a machine is too important for guesswork or rule-of-thumb computations. Only precise methods of comparative cost analysis will give you the right answer. Our sales engineers are well experienced in making obsolescence studies and will be glad to do the same for you. Similar studies have pointed the way to many important savings.

For Example: A manufacturer of aircraft instruments had been using a 5-year-old precision lathe to perform boring, turning and facing operations on instrument cases. But when this was replaced with a new Heald Model 0 Unit-Type Bore-Matic like that shown at the right, operating costs for the same production were immediately reduced by over 78%. In addition, the elimination of a separate burring operation and reduced assembly time made further important savings, as indicated by the cost analysis below.

	Old Machine	New Machine
Parts per hour	4.3	20
Parts per year (Req'd. Prod.)	10,000	10,000
Direct and Indirect Labor, per year	$20,349	$ 6,055
Scrap Losses, per year	$ 500	$ 300
Annual Maintenance Cost	$ 600	$ 300
Annual Operating Cost	$21,449	$ 6,655
Basic Annual Saving, New Machine		$14,794
Additional Saving from elimination of separate operation		$ 500
Additional Saving from reduced assembly time		$ 1,500
Total Saving Per Year		$16,794
Return on Investment for New Machine		84%

YOU pay for obsolescence. Replacement pays for itself!

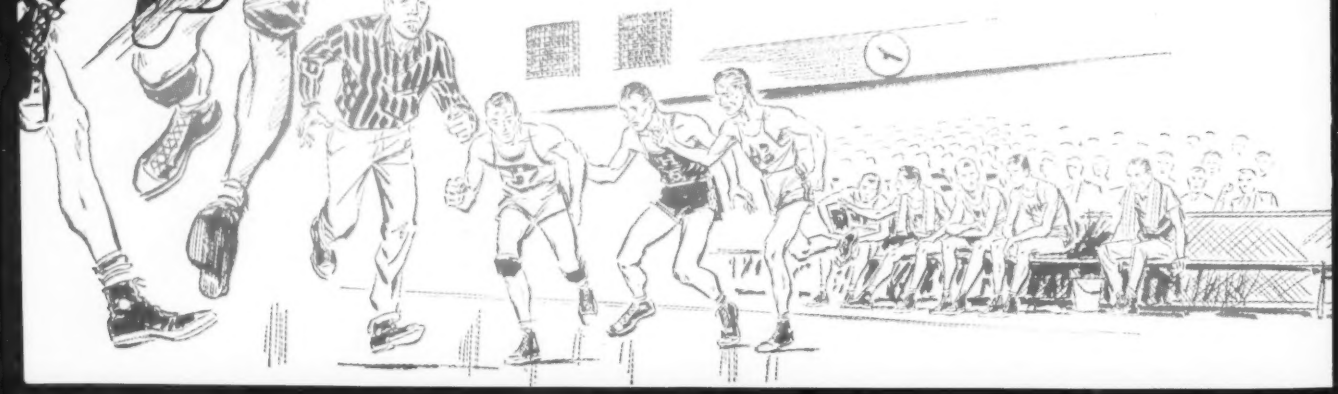
THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Indianapolis • New York

HEALD



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BPA NBP

Machinery

DECEMBER 1958 **VOL. 65 No. 4**

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

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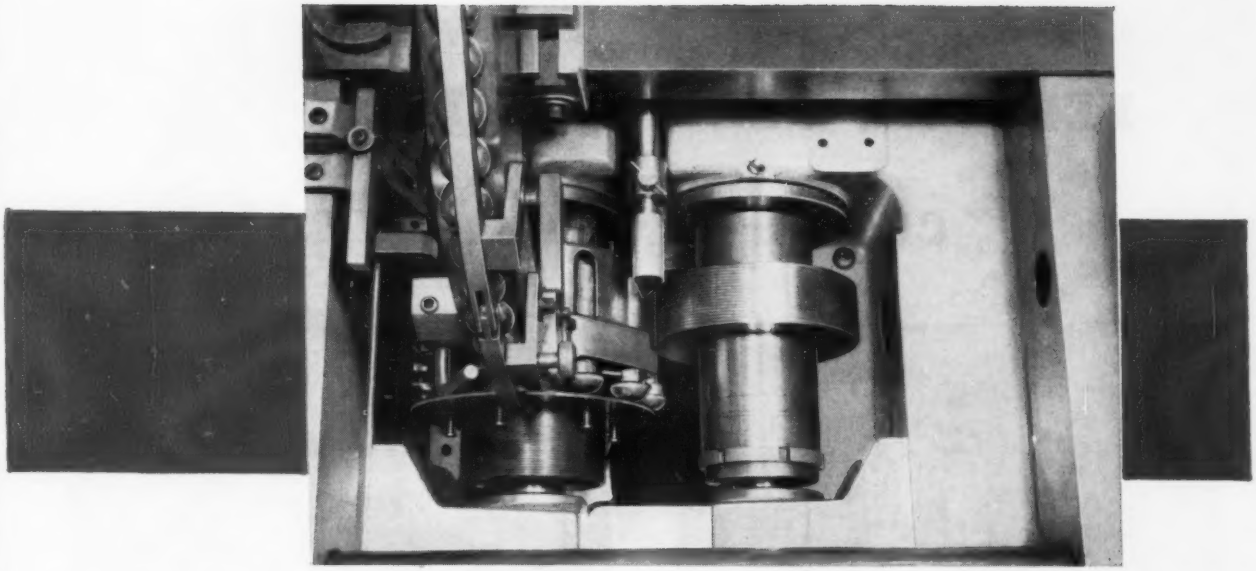
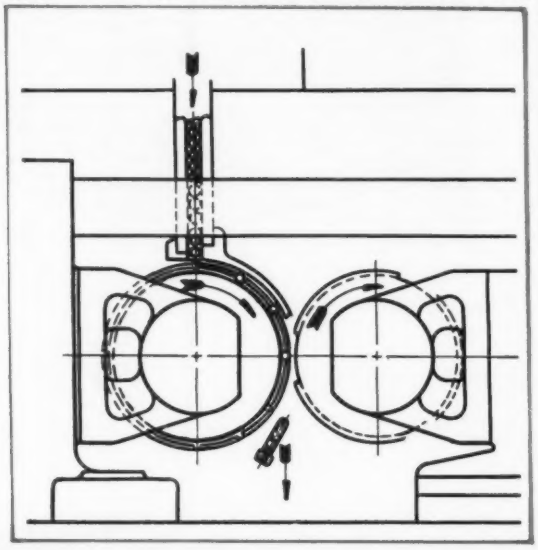
AUTOMATED THREAD ROLLING

with the LANHYROL machine



The automatic features of the LANHYROL Thread Rolling Machine have enabled a large industrial fastener and related parts company to automate its process for producing button head oval neck track bolts. ¾" 10 pitch UNC threads are rolled 1¾" in length to Class 2A fit.

One man now handles the entire operation, eliminating difficult and costly handling of hot-forged bolt blanks required in the old process. Now . . . bolt blanks are cold-formed from 800-lb. coils of hot-rolled steel wire by passing through a wire-drawer into a two-blow header, conveyed to a hopper, threaded by Continuous Rolling on the LANHYROL Machine, and ejected as finished parts into a bin for removal.



Continuous Rolling (illustrated) is one of three thread-rolling methods utilized by the LANHYROL Machine. Blanks are delivered from a hopper to an automatic, indexing-type workrest. This indexes the pieces according to a preset cycle into and away from the rolling position. There, thread-rolling is accomplished by two opposed cam-type rolling dies.

Although the LANHYROL is capable of rolling 80 track bolts per minute, in this application it is only operated to slightly exceed the production rate of the header which is 60 blanks per minute. Thread finish is considerably improved over previous methods and roll life is excellent . . . more than ¾ of a million bolts have been threaded to date with the original roll dies.

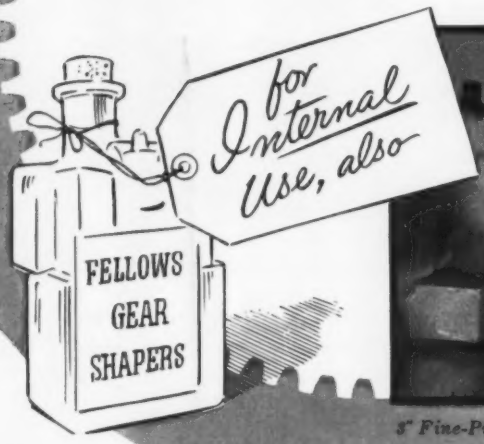
The LANHYROL Machine produces excellent threads at unequalled rates of output, and its method of operation fits well into automated processes. For information on its unusual range and flexibility, and the Infeed and Thrufeed thread rolling methods, send specifications and ask for Bulletin E-60.

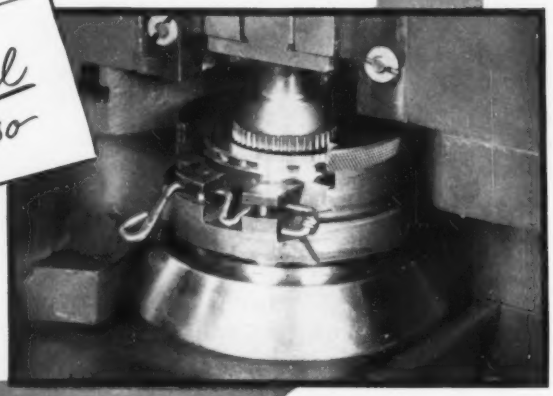
493C

LANDIS Machine COMPANY

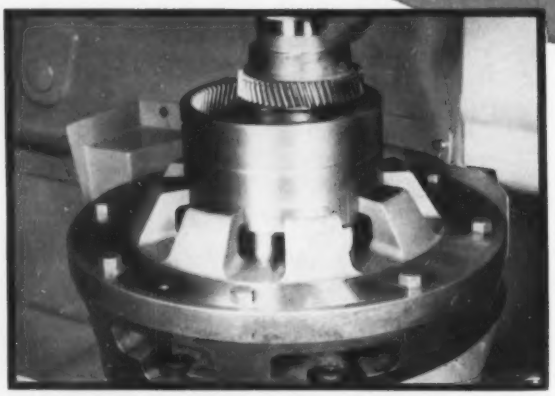
WAYNESBORO • PENNSYLVANIA • U. S. A.

FELLOWS GEAR SHAPERS cut INTERNAL Gears

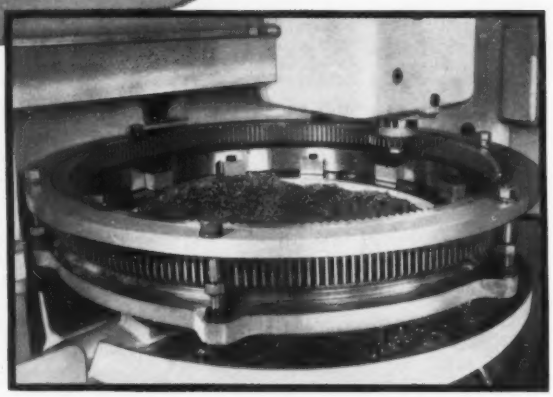




5" Fine-Pitch Gear Shaper cutting internal gear.



No. 10 Rotary Gear Shaper cutting internal helical.

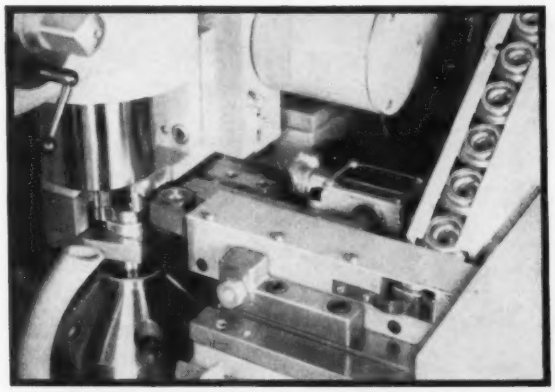


36-Type Gear Shaper with special work-holding fixture.

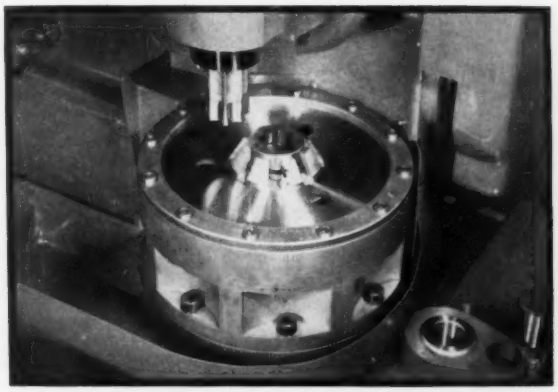
120" Gear Shaper cutting light tank turret gear.

THE
PRECISION
LINE

as EASILY as Externals



4GS Gear Shaper with full-automatic operation.



7A-Type Gear Shaper with fast-action diaphragm chuck.

Not only internal gears, but splines, clutches and an almost unlimited variety of other internal shapes can be produced on versatile Fellows Gear Shapers just as simply, rapidly and economically as external shapes. In many cases, the same Gear Shaper cutter can be used to cut both internal gears and their mating pinions.

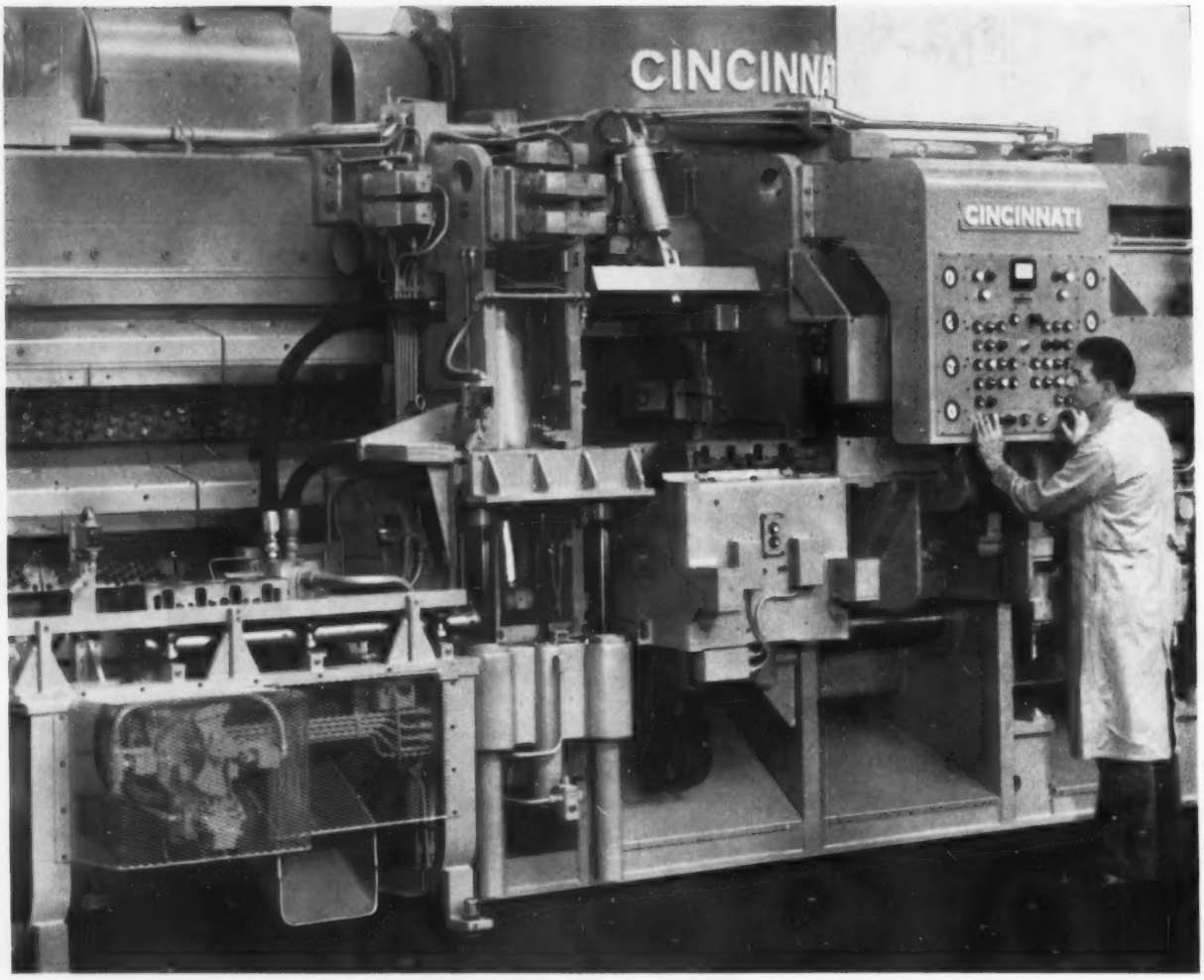
Set-ups and change-overs are simple and fast on any Gear Shaper from the 3-Inch Fine-Pitch to the 120-Inch. Rigid construction makes it possible to hold close tolerances at high production rates. On some models, full or semi-automatic operation is available whenever the size and shape of the work and the production requirements make it practical.

Your Fellows Representative can give you full information about the production benefits of Fellows gear shapers, shaving machines, grinding machines, inspection instruments, or cutting tools. Just contact the nearest Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

Fellows *Gear Production Equipment*

Another New
in Cost of



Cylinder heads are broached on this CINCINNATI Horizontal Hydro-Broach Machine, completely tooled up and ready for installation in a modern, fast-moving production line. Operation—finish broach top face, intake and exhaust manifold faces; rough broach joint face. Production—160 per hour.

CINCINNATI® Special Machine Tools · Vertical and Horizontal

Low Machining Cylinder Heads

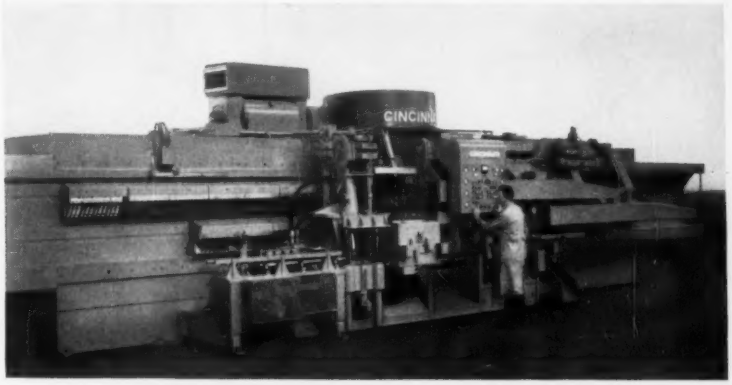
...160 per hour are broached on this Cincinnati

There's only one way for the cost of machining to go: DOWN. And for cylinder heads broached on the CINCINNATI illustrated here, costs go down to a lower level than ever before. This fine Horizontal Hydro-Broach Machine is completely automatic, with single cycle push-button control for start-up after resetting the broach inserts, etc. ¶ Other advantages include elevator for work transfer after second operation; complete power handling of the work; mechanical drive to the ram with speeds up to 200 feet per minute; inserted sintered carbide tools; automatic circulating lubrication; arranged for integration with other machines into automatic production line.

The machine operates at a production rate of 160 cylinder heads per hour.

This outstanding advancement in cylinder head broaching machines may have the effect of making your present equipment economically obsolete. Our Broaching Specialists will help you decide if replacement is in order. May we hear from you?

CINCINNATI



CINCINNATI Horizontal Cylinder Head Broaching Machine. Other machines of this type are illustrated in catalog No. M-1910.

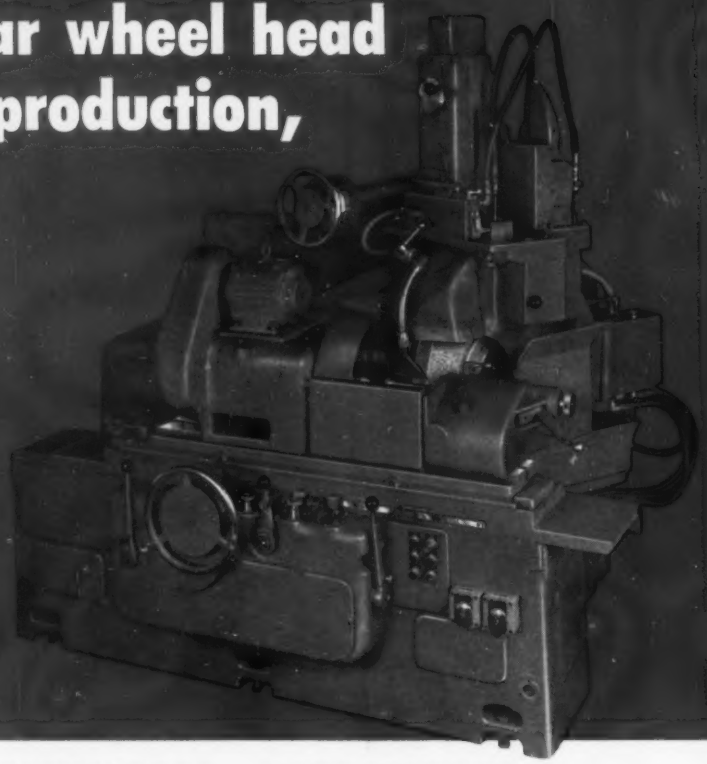
Broaching Machines · Complete Production Lines

SPECIAL MACHINE DIVISION
The Cincinnati Milling Machine Co.
Cincinnati 9, Ohio

For more data, circle page number of this ad on inquiry card

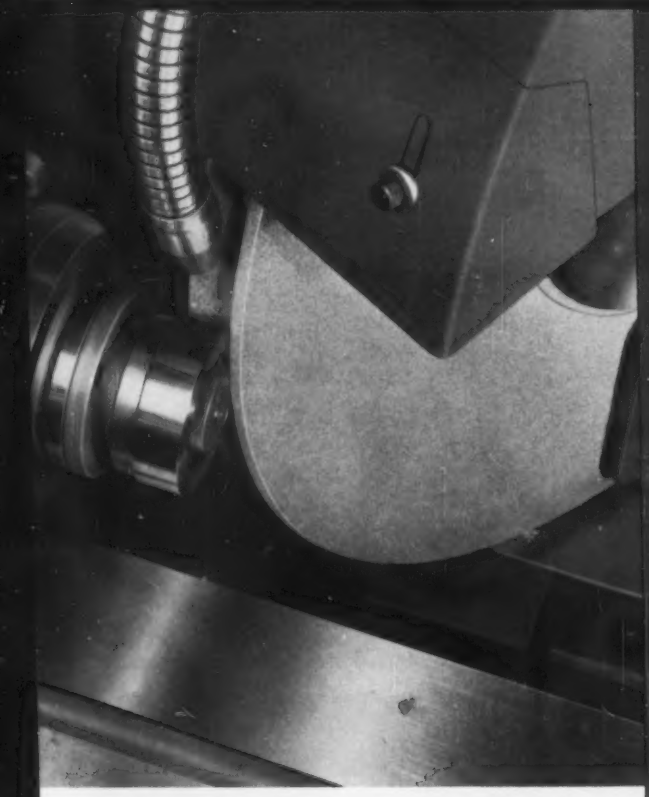
How Landis angular wheel head grinders increase production, lower costs

Landis 30° angular wheel head plain grinders can combine face, multiple diameter and profile grinding into one operation. This replaces single operations, improves quality, lowers setup time and handling time.

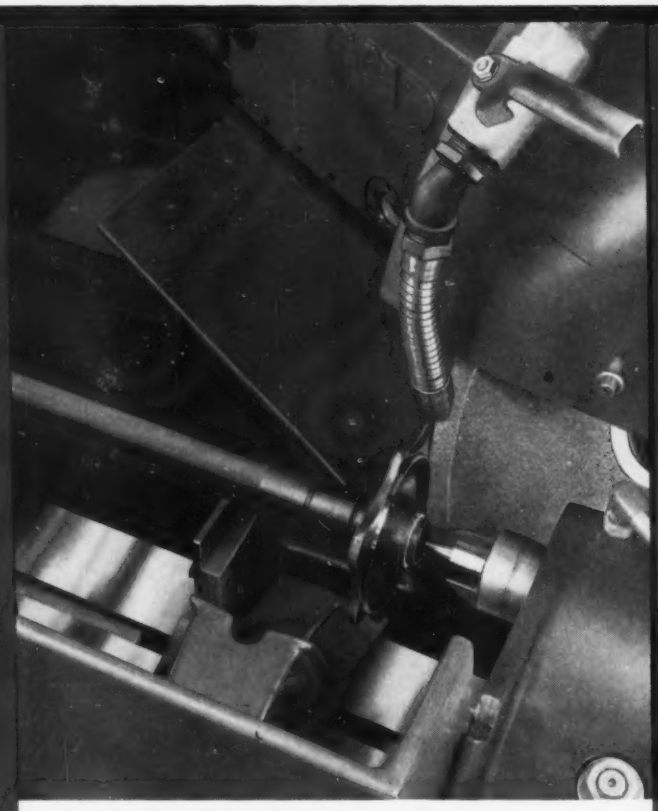


LANDIS
precision grinders

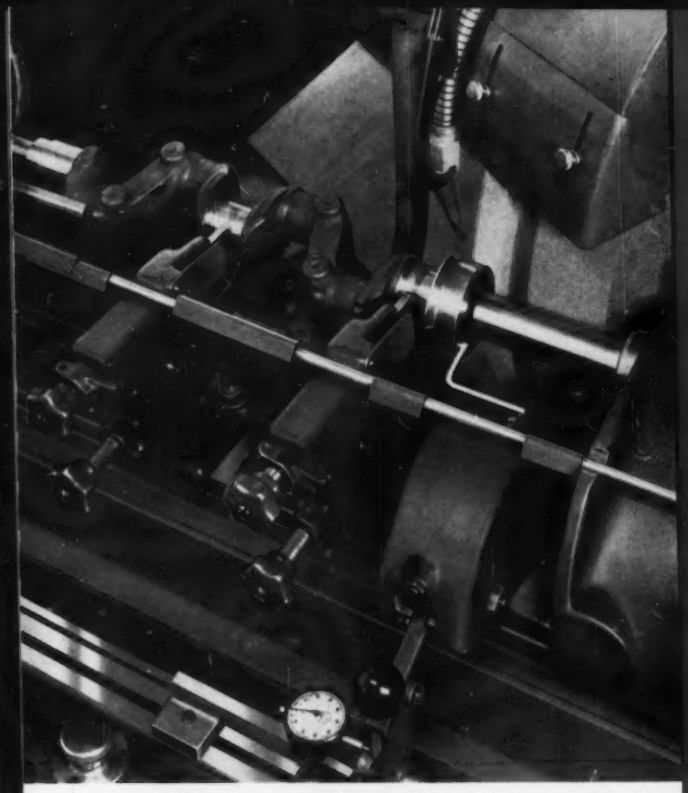
LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA



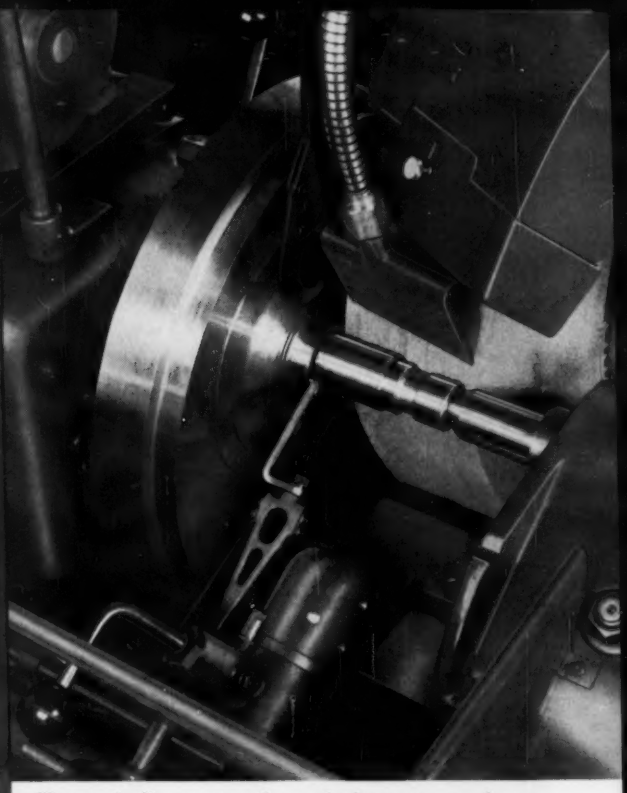
Two grinding operations. Infeed grinding diameter and end of transmission part at same time. Production: 125 per hour.



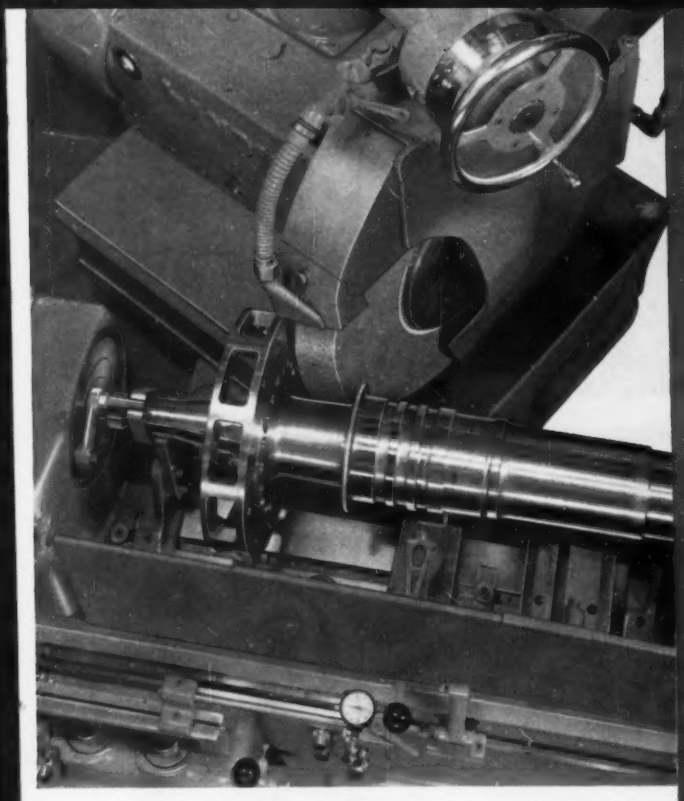
Combining operations. Infeed grinding narrow diameter and flange face of differential shaft in one operation. Production: 65 per hour.



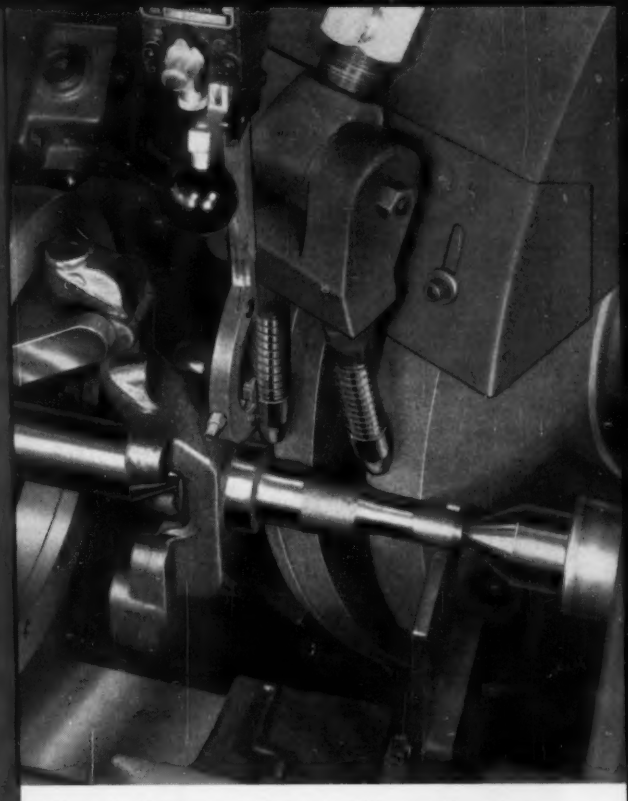
Grinding two diameters and face angle. All 3 ground at one time on light crankshaft.



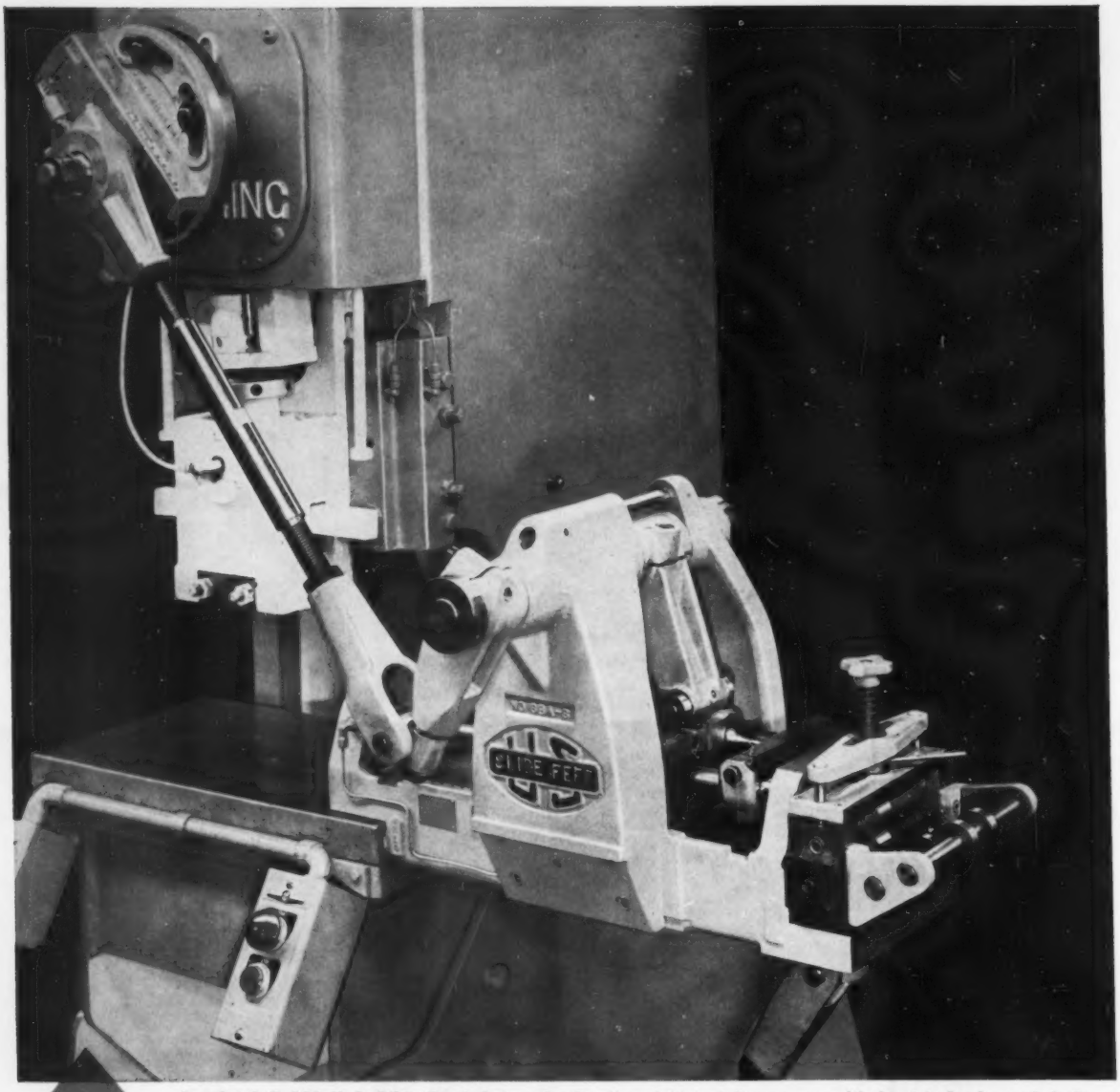
Five grinding operations. 3 diameters, a face and radius ground in one infeed operation.



Grinding face and radius. A large face and a blending radius on turbine shaft ground in one of a series of infeed operations.



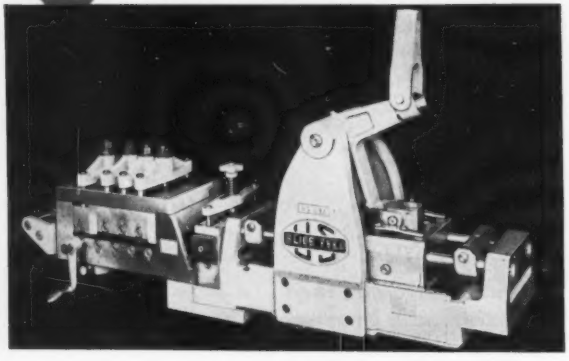
Six grinding operations. 3 different diameters and 3 radii ground in one infeed operation of automotive part at high production.



Special S. F.-68A U. S. Slide Feed. Set-up for Feeding right to left on press with front to back crankshaft.

Close-up of S. F.-68A U. S. Slide Feed showing indicator on feed block and scale on body, used for rapid feed length adjustment.

S. F.-68A U. S. Slide Feed with S. S.-27 U. S. Plain Stock Straightener. Conventional arrangement for feeding from left to right.



Automatic Feeding for punch press profit!

Short run jobs—produced with long-run economy on the new U. S. SLIDE FEEDS.

NEW U. S. SLIDE FEED features reduce press room costs . . . increase production because . . .

1. **LESS TIME NEEDED FOR CHANGEOVER.**
2. **QUICK, VISUAL FEED LENGTH SETTING.**
3. **SIMPLE STOCK THICKNESS ADJUSTMENT.**
4. **UNSURPASSED ACCURACY - WITH OR WITHOUT PILOTS.**
5. **MORE POSITIVE CHECK.**

The U. S. Slide Feed, Model S. F.-68A, illustrated here, feeds stock widths up to 6" and has a maximum feed length stroke of 8". Available for immediate delivery.

For complete information about the new U. S. Slide Feeds, write for Bulletin No. 101. Information concerning other U. S. Press Room equipment is yours by asking for Bulletin No. 85M.

US PRODUCTS

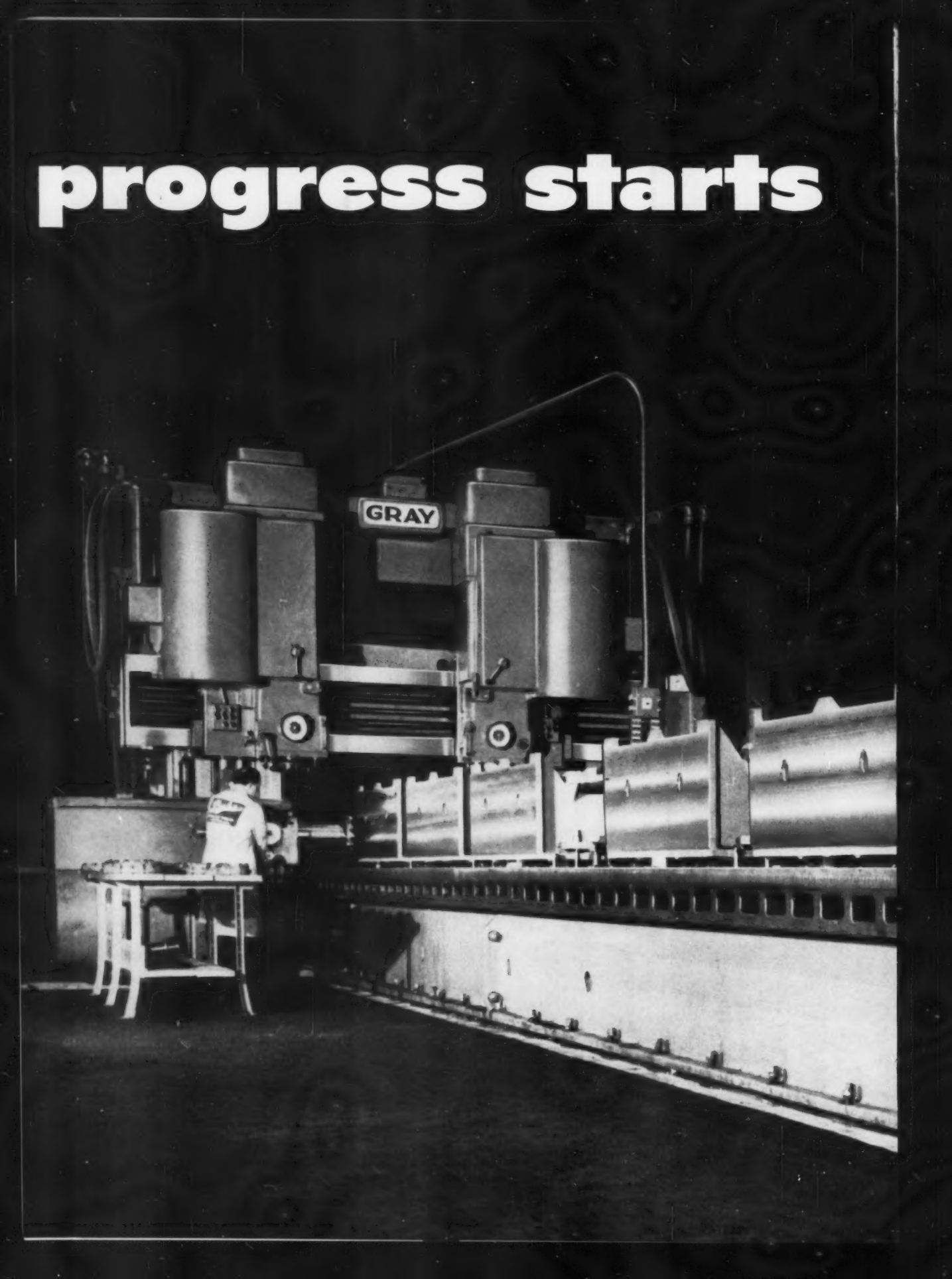
U. S. TOOL COMPANY, INC.

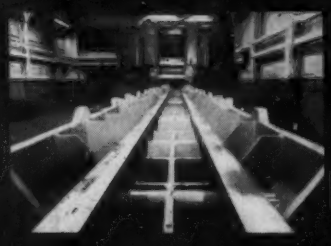
AMPERE *(EAST ORANGE)* NEW JERSEY

U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

For more data, circle page number of this ad on inquiry card

progress starts



on  a GRAY

What you see being milled on this big 105 foot long Gray, are transfer machine bases of the future...six at a time...automation production machines of Buhr Machine Tool Co., of Ann Arbor, Michigan. It's logical that this company, engaged in producing cost cutting, time saving equipment, should select a cost cutting, time saving Gray to do the job.

Gray unit head planer type millers dominate the field of modern heavy duty milling. This 66" x 66" x 50' giant can simultaneously deliver 300 H. P. to its four cutters. Duplex tables virtually eliminate idle time by permitting work set-up on one section, while work is being milled on the other section. Unusually simple control encourages maximum operator efficiency. All this, plus mirror smooth surfaces milled to precise tolerances maintain the Gray reputation for top quality the world over.

The G. A. GRAY Co., Cincinnati 7, Ohio

Now—FINISH FLAT

New Norton 6" x 18" Surface Grinder Ready For Immediate Delivery

You FINISH FLAT FASTER with the new Type S-3 hydraulic which is equally efficient for long production runs or a wide variety of toolroom grinding because of its new cost-cutting features. It produces plane surfaces smoothly — with automatic or manual cross feed and with such fast, cool-running action that it saves time and money on every job.

Ask your Norton Representative for the whole story. Or write us direct for Catalog 2128. And remember: only Norton Company offers you such long experience in both grinding machines and grinding wheels to bring the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

Profit from these benefits

1. Get Jobs Done Fast and Cool — high table speed, *125 feet per minute, maximum.* **2. Handle Tall Work Pieces** — greater vertical capacity, *15"*. **3. Get Lasting Accuracy** with guide-rail cross slide construction. **4. Control Vertical Feed Accurately and Position Fast** with two-speed .0001" increment hand wheel. **5. Benefit from Better Sighting and Loading** due to contoured splash guards. **6. True Forms, Even on Worn Wheels** because of recessed wheel spindle housing.

To Economize, Modernize with **NEW**

NORTON

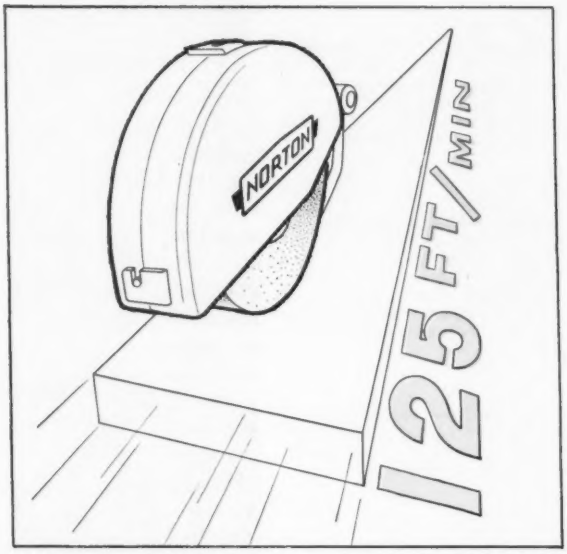
GRINDERS and LAPPERS

Making better products... to make your products better

NORTON PRODUCTS
Abrasives • Grinding Wheels • Grinding Machines
Refractories • Electrochemicals
BEHR-MANNING DIVISION
Coated Abrasives • Sharpening Stones
Pressure-Sensitive Tapes
District Offices
Worcester • Hartford • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5

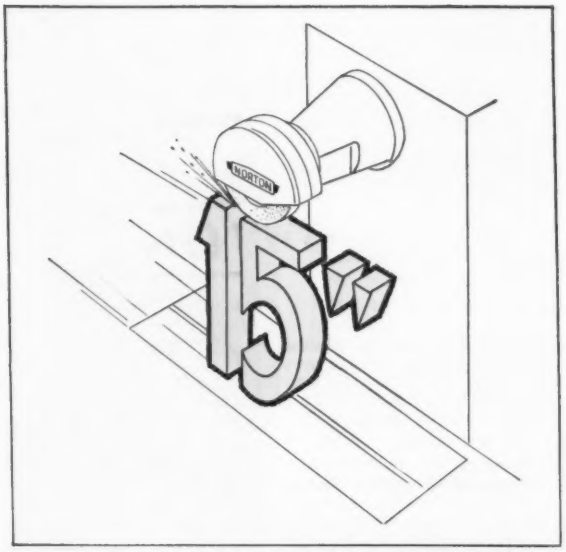
FASTER.... at lower cost

These and many other new features make this machine a "must" for your surface grinding jobs.

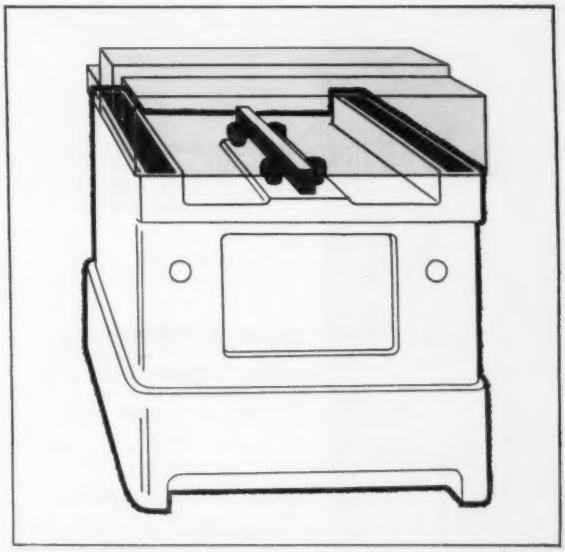


Finish flat faster, cut grinding time and increase production, with high table speed, 125 feet per minute.

Heat goes off in the chips, due to new, high table speed. This cooler grinding permits faster production on heat-sensitive metals.



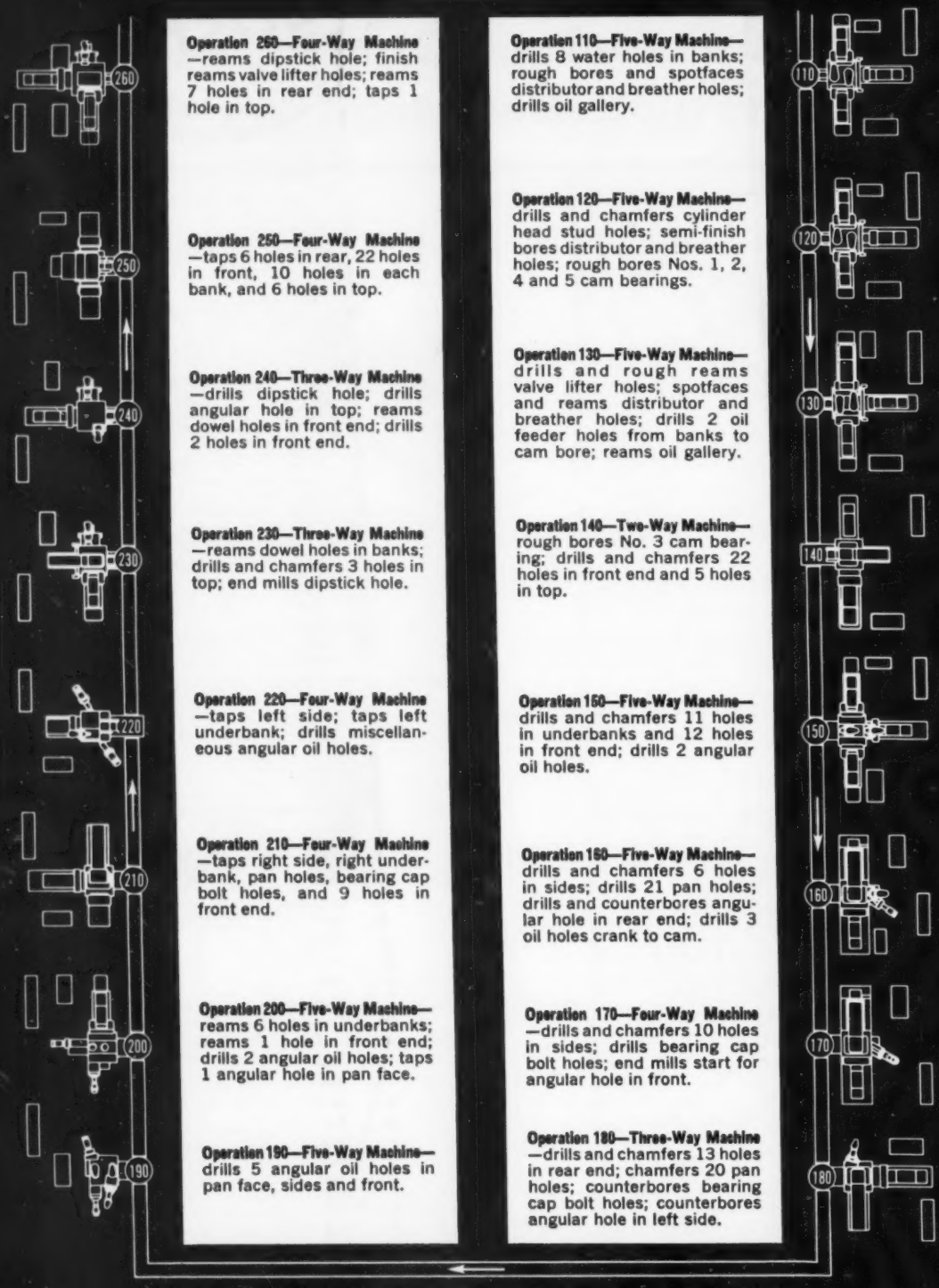
Handle taller work pieces with high-grind wheel head construction. The vertical capacity from the table top to the bottom of standard full size 8" diameter grinding wheel is 15"



Widely spaced, flat ways and guide-rail cross slide design maintain cross feed accuracy, providing lastingly accurate grinding of shoulders or parallel surfaces.

For more data, circle page number of this ad on inquiry card

Automation for Low Volume Production



Operation 260—Four-Way Machine—reams dipstick hole; finish reams valve lifter holes; reams 7 holes in rear end; taps 1 hole in top.

Operation 250—Four-Way Machine—taps 6 holes in rear, 22 holes in front, 10 holes in each bank, and 6 holes in top.

Operation 240—Three-Way Machine—drills dipstick hole; drills angular hole in top; reams dowel holes in front end; drills 2 holes in front end.

Operation 230—Three-Way Machine—reams dowel holes in banks; drills and chamfers 3 holes in top; end mills dipstick hole.

Operation 220—Four-Way Machine—taps left side; taps left underbank; drills miscellaneous angular oil holes.

Operation 210—Four-Way Machine—taps right side, right underbank, pan holes, bearing cap bolt holes, and 9 holes in front end.

Operation 200—Five-Way Machine—reams 6 holes in underbanks; reams 1 hole in front end; drills 2 angular oil holes; taps 1 angular hole in pan face.

Operation 190—Five-Way Machine—drills 5 angular oil holes in pan face, sides and front.

Operation 110—Five-Way Machine—drills 8 water holes in banks; rough bores and spotfaces distributor and breather holes; drills oil gallery.

Operation 120—Five-Way Machine—drills and chamfers cylinder head stud holes; semi-finish bores distributor and breather holes; rough bores Nos. 1, 2, 4 and 5 cam bearings.

Operation 130—Five-Way Machine—drills and rough reams valve lifter holes; spotfaces and reams distributor and breather holes; drills 2 oil feeder holes from banks to cam bore; reams oil gallery.

Operation 140—Two-Way Machine—rough bores No. 3 cam bearing; drills and chamfers 22 holes in front end and 5 holes in top.

Operation 150—Five-Way Machine—drills and chamfers 11 holes in underbanks and 12 holes in front end; drills 2 angular oil holes.

Operation 160—Five-Way Machine—drills and chamfers 6 holes in sides; drills 21 pan holes; drills and counterbores angular hole in rear end; drills 3 oil holes crank to cam.

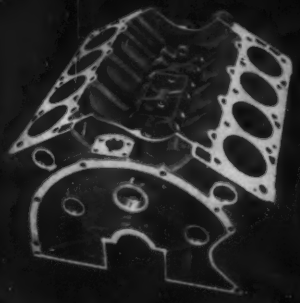
Operation 170—Four-Way Machine—drills and chamfers 10 holes in sides; drills bearing cap bolt holes; end mills start for angular hole in front.

Operation 180—Three-Way Machine—drills and chamfers 13 holes in rear end; chamfers 20 pan holes; counterbores bearing cap bolt holes; counterbores angular hole in left side.

Floor plan of 16 single station machines for processing cylinder blocks

More Specials by Cross

Five-way machine operation 120



Here is a new kind of manufacturing line—one that utilizes automation for low volume production. It machines truck engine blocks at the rate of 15 per hour.

The unique material handling arrangement for the line permits one operator to take care of several of the 16 machines. To load any machine, the operator merely places the part on the turntable, rotates it 90 degrees, moves it about six inches toward the machine and pushes the cycle button. The machine then takes hold of the part, draws it into the work holding fixture, locates and clamps it, performs the machining operation and ejects it back onto the turntable—all automatically.

Other features include: complete interchangeability of all standard and special parts, construction to JIC Standards, hardened and ground ways, hydraulic feed and rapid traverse, and automatic lubrication.

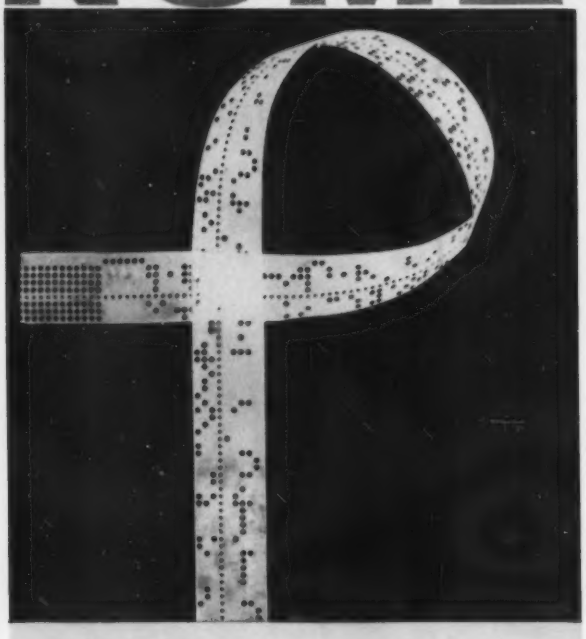
Established 1898

THE CROSS CO.

First in Automation

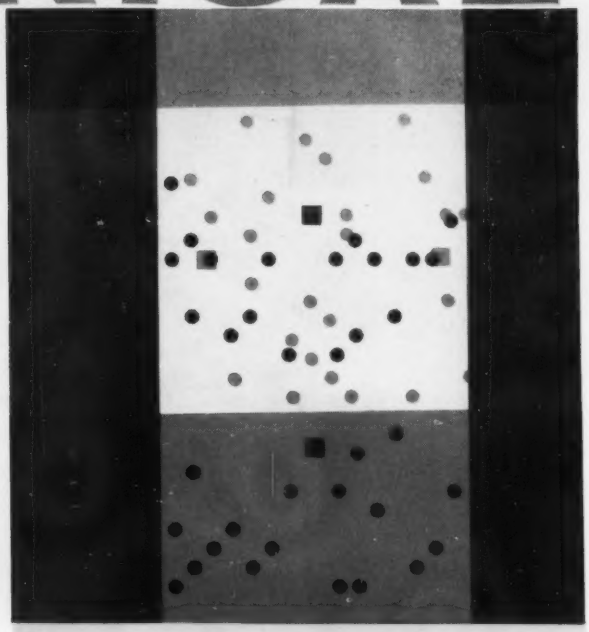
PARK GROVE STATION • DETROIT 5, MICHIGAN

NUMERICAL



1″ 8-CHANNEL COMMUNICATIONS TAPE

Inexpensive, widely used throughout industry, these tapes may be prepared simply on a Flexowriter or similar equipment, usually by the Production Engineering Dept. Provides a typewritten record automatically for easy checking against pre-planned program.



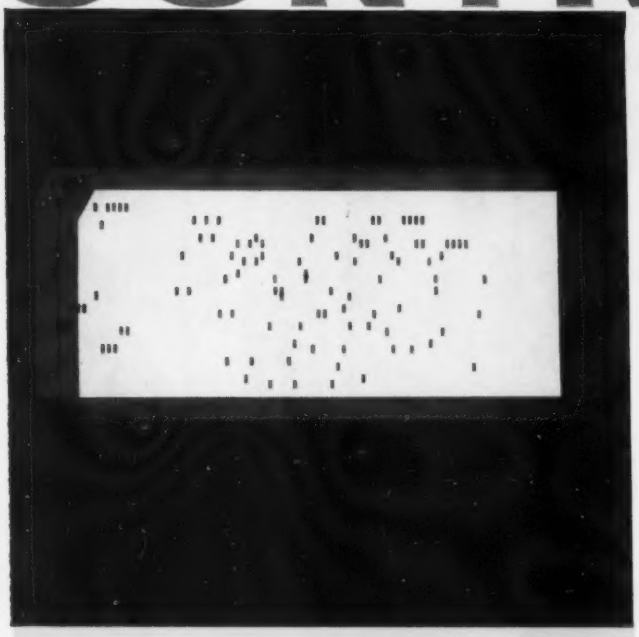
4″ MYLAR PLASTIC TAPE

Least expensive of the generally accepted tape systems, particularly suitable for smaller shops machining parts with relatively few holes. Tape can be prepared easily by shop personnel.

1″ 8-CHANNEL COMMUNICATIONS TAPE

4″ MYLAR PLASTIC TAPE

CONTROL



PUNCHED CARDS

This system can be integrated with card systems already in use by your company. Each job is programmed in a "deck" of cards; provides great flexibility, since an operation can be added or eliminated simply by making a new card or removing an old one.

for Fosmatic JIG BORERS and JIG GRINDERS

Any tape or card reader can be used to control a Fosmatic Jig Borer or Jig Grinder. And because the functions of the standard Fosmatic are actuated electrically, numerical control can be installed in the field—economically!

Speeds and feeds are changed by controlling electro-magnetic clutches through relay contacts. Table and saddle position is determined by a measuring system actuated by direct reading dials. For numerical control, these dials are driven by a fractional hp motor.

On a Fosmatic, you can program as many functions as you wish. Table X and Y positions (to .0001"), Feeds and Speeds, Spindle start and stop, Spindle feed start and stop, Spindle feed depth, Spindle head height, Automatic tool change. And only Fosmatic gives you a visual numerical check of coordinate location plus operation sequence number.

Example of savings made with Fosmatic numerical control. The illustration (left) shows one half of a mold with 900 cavities, each of which requires nine operations—a total of 8100! Time for the entire job was 100.25 hours, 25% of time consumed previously on a conventional jig borer.

Write or call today for complete information on a numerically controlled jig borer or jig grinder to improve your production method.

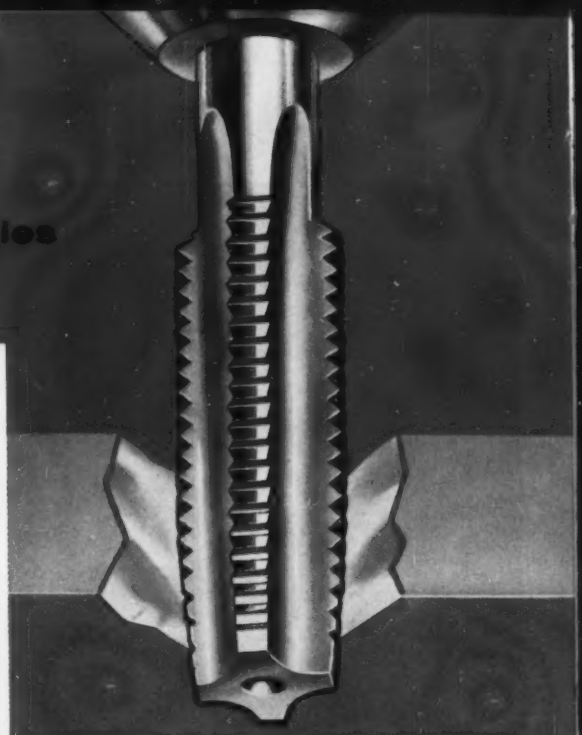
PUNCHED CARDS

Buy a Fosmatic today—add Numerical Control tomorrow

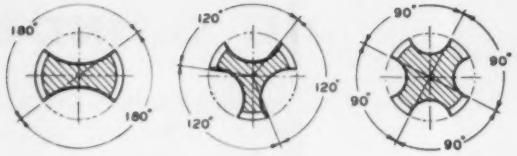
For more data, circle page number of this ad on inquiry card

4 Reasons

why you get greater accuracy and uniformity of tapped holes with BALANCED ACTION



1



EXACT FLUTE SPACING

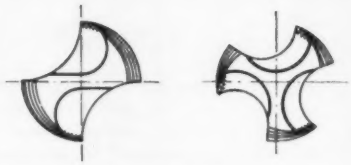
A prerequisite to exclusive Balanced Action performance, flute spacing determines the balance of the tap. Winter achieves exact spacing through precise indexing.

2

UNIFORM FLUTE CONTOURS

Another element of Winter design "teamwork", uniform flute contour is an integral part of Balanced Action. Controlled flute contours are vitally important to proper tapping of specific materials.

3



PRECISION CHIP DRIVER CONTOURS

To eliminate inaccuracies of off-hand grinding and polishing, Winter designed and built special machines to assure perfect chip-driver contours.

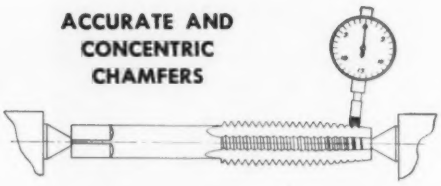
WINTER

CALL YOUR DISTRIBUTOR for standard and special WINTER Balanced Action Taps, Dies, and Gages.

WINTER BROTHERS COMPANY, Rochester, Michigan, U.S.A. Distributors in principal cities. Branches in New York • Detroit • Chicago Dallas • San Francisco • Los Angeles • Division of National Twist & tool Co.

4

ACCURATE AND CONCENTRIC CHAMFERS



The last—but not the least—important element of Balanced Action, accurate and concentric chamfers eliminate tap run-out. Winter holds shank, chamfer and thread concentricity to remarkably close limits.

Increase your cutting efficiency

with research improved National metal slitting saws

National metal slitting saws give you the edge for tool room or production work because they're job-engineered to minimize binding and scoring. Made of the finest quality high-speed steel for long life, National saws are available in a wide range of diameters and widths to do a variety of operations—including multiple slotting, grooving, slitting, cutting off—efficiently and economically.

CALL YOUR DISTRIBUTOR for **NATIONAL** twist drills, reamers, counterbores, milling cutters, end mills, hobs, carbide and special tools.

National

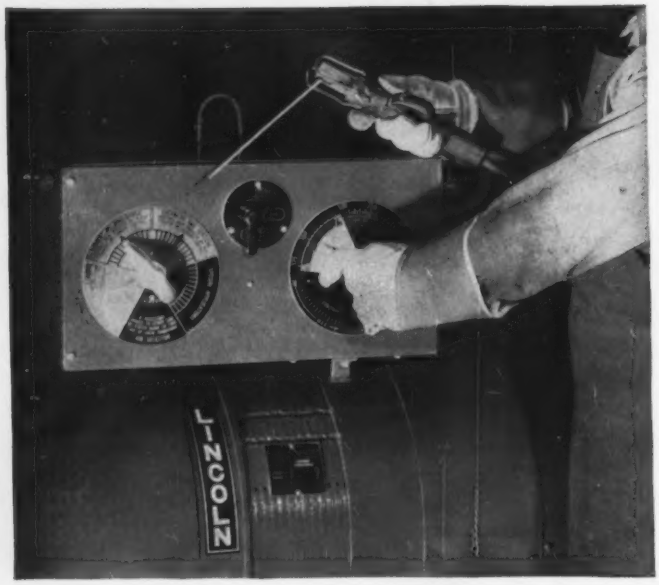
NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in
New York • Detroit • Chicago • Dallas
San Francisco • Los Angeles

Weldynamics

ARC WELDING AT WORK CUTTING COSTS



Shield-Arc motor-generator welders are available in 200, 300, 400 and 600 amp sizes; portable or stationary; for AC or DC power supply. Specifications and engineering data are contained in Bulletin SB-1362. Sent on request.

In Your Shop you can take advantage of Weldynamics by providing your weldors with the most efficient equipment.

Lincoln Shield-Arc Motor-Generator Welders are Weldynamically designed for fast, easy welding under any conditions.

Dual Continuous Controls allow the weldor to select the kind of arc he likes to work with. He uses the current control to select the welding heat, and the voltage control to select arc "snappiness" and to fine-tune the welding heat.

Nearly Every Weldor is familiar with Lincoln Shield-Arc Welders, and most weldors prefer them.

Lincoln Applies Weldynamics in its own plant to cut manufacturing costs. These savings are passed on to you in better welding products for less cost.

Lincoln Representatives are trained in Weldynamics. They are equipped to help you with procedures, equipment and design. A letter or phone call is all it takes.

The World's Largest Manufacturer of Arc Welding Equipment

© 1958 The Lincoln Electric Company

LINCOLN

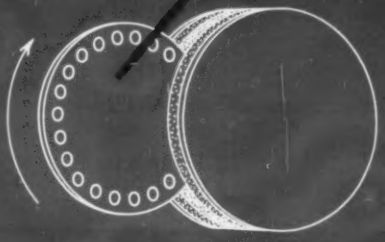
THE LINCOLN ELECTRIC COMPANY • DEPT. 1231 • CLEVELAND 17, OHIO

For more data, circle page number of this ad on inquiry card

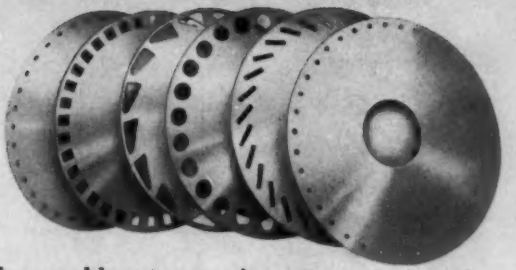
Interchangeable work carriers add profitable versatility to Gardner Disc Grinder

...rotary work carriers handle wide variety of parts in grinding two parallel surfaces in one operation

Gardner 2H30 precision double spindle grinder with rotary work carrier



Rotary work carrier is a high production means of grinding two parallel sides in one operation. Loading and unloading can be manual or automatic.



Interchangeable rotary work carriers can be adapted for workpieces of many shapes.

Typical parts: . . . . . washers, rings, bearing rollers, bearing races, gears; metal, ceramic, plastic, etc.
Production: . . . . . 600 to 2100 parts per hour
Stock removal: . . . . . .008" to .010"
Flatness: . . . . . .0001"-.0003"
Parallelism: . . . . . .0001"-.0004"
Uniformity: . . . . . .0015"-.002"

GARDNER

precision disc grinders

BELOIT, WISCONSIN

Profit-saving Performance on every job!

THE NEW BROWN & SHARPE 618 MICROMASTER SURFACE GRINDING MACHINE

THE NEW 618 is designed by Brown & Sharpe specialists to deliver new savings and profits on every type of surface grinding job. It provides *all* the capacity, *all* the speed and efficiency you need to meet today's toughest demands in the toolroom and in continuous production runs. You get *300% faster* table speed range . . . *60% larger* work space area . . . *super-precision* performance.

BEFORE YOU BUY any surface grinder, be sure to see a demonstration of the new 618 at one of the locations listed below. See for yourself how much *more* you get for your investment — how much *more* it will pay you in cost-reduction dividends. For complete information, call or write any Brown & Sharpe machine tool dealer, district office, or: Brown & Sharpe Mfg. Co., Providence 1, R. I.

See all these MICROMASTER advantages — and many more

- **FASTER, COOLER GRINDING** — any desired table speed from 5 to 100 ft. per min.
- **TAKES BIGGER WORK PIECES** — up to 14" high under 8" wheel — up to 18" with extra equipment
- **"MICROMASTER" PRECISION** — graduations read to 0.0001" on vertical feed and 0.0002" on cross feed handwheels
- **ULTRA-SMOOTH "ORIFLEX DRIVE"** to wheel spindle, with choice of super-precision, sealed antifriction bearing or plain bearing unit. Direct motor drive optional with antifriction bearing spindle only
- **OPTIONAL ELEVATING HANDWHEEL LOCATION** — on front of bed or on upright
- **ACCURATE SLOT GRINDING** — table mounted directly on precision V and flat guide ways in table base casting — no carriage — no table "twist" — no clamps required. Cog belt drive to table for smooth, positive hand travel
- **CONTINUOUS HYDRAULIC CROSS FEEDS** of 10" per min. for wheel truing and 144" per min. for rapid transverse positioning of wheel spindle upright
- **SINGLE CONTROL** permits restarting at pre-selected table speeds
- **RUGGED SPINDLE SLIDE, UPRIGHT, AND BED** of cast iron, to assure highest accuracy and surface quality
- **AUTOMATIC LUBRICATION** — assures long wear, simplified maintenance
- **COMPLIES WITH BASIC JIC ELECTRICAL STANDARDS**

See a DEMONSTRATION of the NEW BROWN & SHARPE 618 MICROMASTER at any of these B&S MACHINE TOOL DEALERS . . .

BOSTON, MASSACHUSETTS
Chandler & Farquhar Co., Inc.

FAIRFIELD, CONNECTICUT
J. L. Lucas & Son, Inc.

NEW YORK, NEW YORK
Morey Machinery Co., Inc.

NEWARK, NEW JERSEY
Morris Machinery Co., Inc.

BALTIMORE, MARYLAND
Carey Machinery & Supply Co.

CHARLOTTE, NORTH CAROLINA
The Henry Walke Company

BUFFALO, NEW YORK
Alexander & Fiden Mach'y Co., Inc.

PHILADELPHIA, PENNA.
W. B. Rapp Machinery

YORK, PENNSYLVANIA
York Machinery & Supply Co.

ERIE, PENNSYLVANIA
Boldt Machinery & Tools

DAYTON, OHIO
Jones Machinery Company

DETROIT, MICHIGAN
Modern Machinery Sales Co.

FLINT-SAGINAW, MICHIGAN
Gransden-Hall & Co.

CHICAGO, ILLINOIS
Harry Lee & Sons

INDIANAPOLIS, INDIANA
American Mach'y & Tool Co., Inc.

MINNEAPOLIS, MINNESOTA
Northern Mach'y & Supply Co.

SAINT LOUIS, MISSOURI
Colcord-Wright Mach'y & Sply. Co.

DENVER, COLORADO
R. E. Duboc Associates

TULSA, OKLAHOMA
Marshall Supply & Equip. Co.

HOUSTON, TEXAS
Wessendorff, Nelms & Co.

and at **BROWN & SHARPE Sales Offices** in AUBURN, MASS. — UNION, N. J. — DETROIT, MICH. — BELLWOOD, ILL. — LOS ANGELES, CAL.

For more data, circle page number of this ad on inquiry card

**HYDRAULIC*
6" x 18"**

*Also available with
– Hydraulic Table Speeds and Hand Cross Feeds
618PH
– Hand Feeds Only
618H

starting Nov. 24th

DALLAS, TEXAS
Briggs-Weaver Machinery Co.

SALT LAKE CITY, UTAH
J. M. Grisley Machine Tools

SEATTLE, WASHINGTON
Perine Mach'y & Supply Co., Inc.

PORTLAND, OREGON
The Portland Machinery Co.

LOS ANGELES, CALIFORNIA
Darnall Machinery Co.

MONTREAL, QUE. and TORONTO, ONT., CANADA
The Canadian Fairbanks-Morse Co., Ltd.

Brown & Sharpe

MACHINE TOOL DIVISION

MILLING • GRINDING • SCREW MACHINES

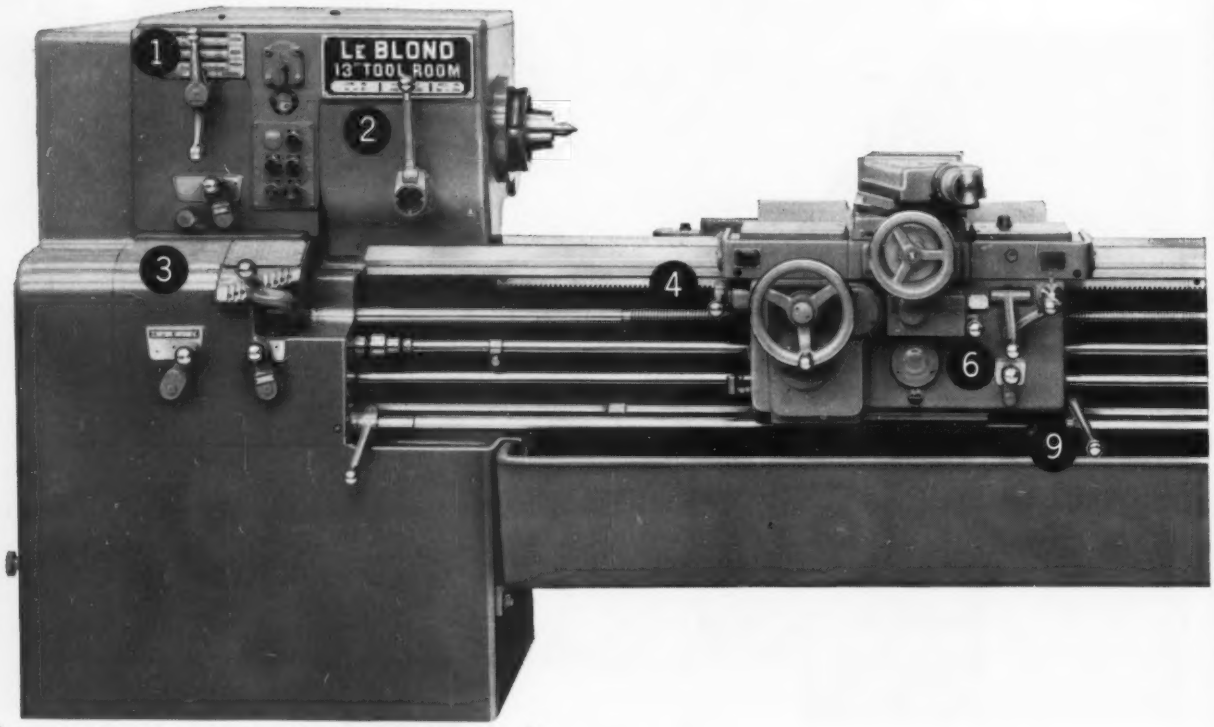
MACHINE TOOL ACCESSORIES

B·S

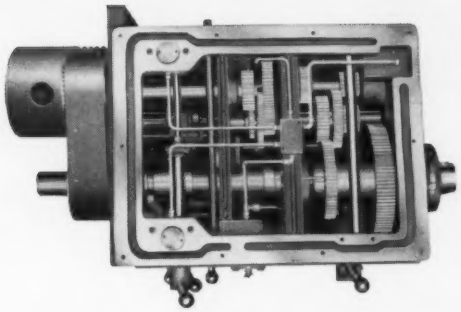
PROGRESS IN PRECISION FOR OVER 125 YEARS

announcing . . . the

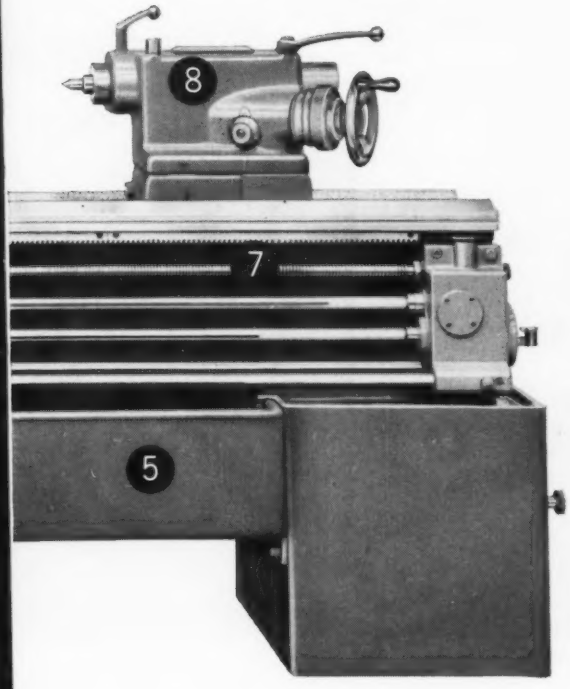
13" LeBlond precision



1. *27 spindle speeds easily chosen by direct-reading color plate*
2. *Combination gear-belt drive headstock*
3. *Totally enclosed quick change box; 60 feeds and threads*
4. *Single-lever 4-way power rapid traverse*
5. *Chip pan slides in grooves; easy clean out*
6. *One-piece totally enclosed apron; ample carriage bearing surface*
7. *Rigidly ribbed bed with hardened and ground steel ways*
8. *2-speed thrust-lock tailstock with quick-set length dial*
9. *Apron controlled leadscrew reverse*



new
toolroom lathe



combination gear-belt headstock

The headstock of the new LeBlond 13" Precision Toolroom Lathe incorporates combination gear-belt drive, delivers 27 speeds ranging from 18 to 2250 rpm. A timing-type non-slip belt is used for the nine high speeds; lower speeds are gear-driven. A color index plate makes speed selection easy for the operator. A constant speed motor supplies up to 20 h.p. to the gear train through an electric clutch and brake (standard equipment).

adjustments for starting, stopping, jogging

Heavy work pieces are brought up to speed safely with rheostatic controls to the electric clutch and brake. Torque applied for the first six seconds is adjustable to any percentage of full torque. Similar adjustments for stopping and jogging.

high-speed spindle mounting

Front and center bearings are Timkens in cone-adjusted mountings. The center bearing cup is mounted in a special high speed precision adapter which relieves potential excessive preload—resulting from the inevitable heat of high-speed operation. Front and center mountings are thrust bearings. The original factory-set preload can handle both high and low speeds—no need to reset bearing adjustments in the field.

spur gear design

Minimizes no-load horsepower. Only gears for a specific speed are engaged. Spur gears are fine pitched and wide to give better tooth action and great load carrying capacity. Short, heavy shafts minimize deflection, are mounted on anti-friction bearings. Spindle is completely ground, nose is hardened. Taper nose key drive is positive, simplifies set-up. Provision for multiple-start threads is made with a large easy-to-read dial at the rear of the spindle. A forced feed system lubricates every moving part in the headstock with filtered oil.

other models available

In addition to the new 13" Toolroom, a new 13" LeBlond Heavy Duty Lathe is also available. Both can be obtained in plain bed gap models. See your LeBlond Distributor or write today for complete details. Ask for Bulletin T-103D (toolroom) or Bulletin HD-103D (heavy duty).

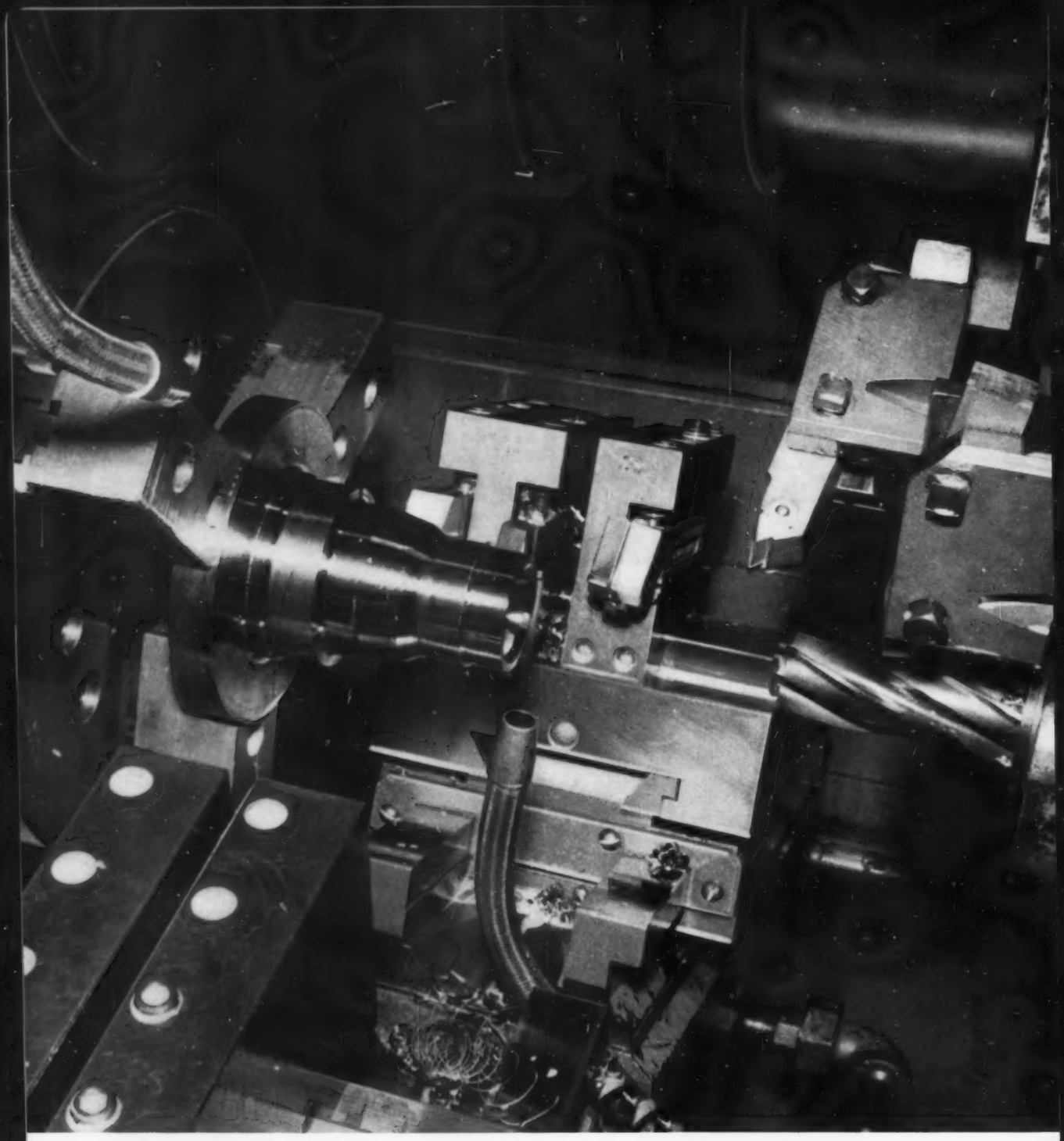
...cut with confidence

THE R. K. LEBLOND MACHINE TOOL COMPANY

Cincinnati 8, Ohio

LEBLOND of Cincinnati

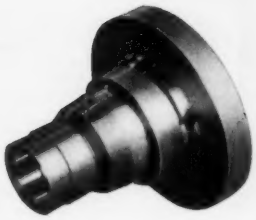
World's Largest Builder of a Complete Line of Lathes for More Than 71 Years



Tooling stations with room to work permit time-saving multiple cuts to be set up easily, quickly on Warner & Swasey ACs. In this close-up photo of three stations on the first chucking of the 325-Stainless Steel nozzle, eight cutters are shown — three on the rear cross slide, two on the front cross slide and three in the turret station. The entire setup employs 16 cutters in seven stations. The skill and know-how of Crosby's own organization has handled the complete tooling of well over 100 similar parts — a tribute to the ease of tooling ACs to produce complicated parts in tough materials to close tolerances and fine finishes.

At Crosby Valve & Gage Company

WRENTHAM, MASS.



Production of Nozzles from 325-Stainless Forgings Nearly Tripled on Warner & Swasey "2ACs"

Further substantial cost savings are realized, too, because one operator easily tends the two Single Spindle Chucking Automatics — averaging as much production as six older hand turret lathes.

Machining tough materials is routine for this long-established Wrentham, Massachusetts, producer of quality safety and relief valves for the steam, petroleum, chemical and food industries.

For example, three pounds of metal are removed from these tough 325-Stainless Steel forgings during the first or roughing operation. Finish operations in the second chucking include a 14 and 16-pitch "V" form thread — tolerances of .002" — a 32 micro-inch finish — and two diameters, two faces and a bore that must be free of tool withdrawal marks. Output increased from 6½ to 17 pieces each 8-hour shift — a boost of 162%!

Compared to previously-used single spindle automatic chuckers, Crosby's new Warner & Swasey 2ACs are averaging up to 100% more production with 25% less time required to set up.

Crosby reports they especially like their 2ACs:

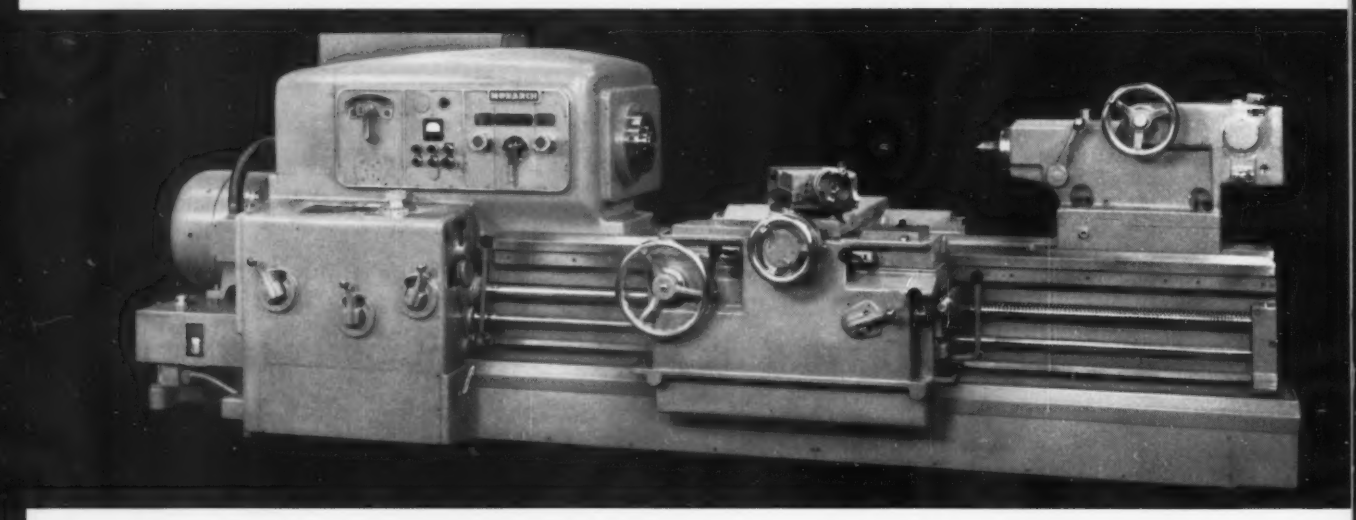
- **EASE OF TOOLING**—cross slide versatility, freedom from tooling interferences, ease of relieving turning, boring and facing cuts.
- **POSITIVE MECHANICAL THREAD LEAD CONTROL** for fine pitch threading accuracy in tough materials.
- **TWO-SPEED MOTOR** that gives greater choice of speeds, permitting efficient low speed threading as well as high speeds for finishing cuts.
- **RIGIDITY AND ACCURACY OF OVERHEAD TURRET DESIGN**—holding close tolerances and fine finishes no longer a problem.
- **CROSS SLIDE RIGIDITY AND SMOOTHNESS OF OPERATION**—cutter life on form cuts increased 2 to 1 over their other single spindle automatics.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

You Can Produce it Better, Faster, for Less... with a Warner & Swasey

For more data, circle page number of this ad on inquiry card

BIG-BY 2 YARDSTICKS!



Heavy duty lathes are intended primarily for heavy stock removal from large work having considerable weight. But more than massive machine components and swing capacity are required. The basic consideration is almost always greater production, therefore lowered costs.

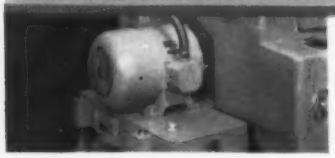
This you get in the Monarch Series 80 Heavy Duty Dyna-Shift—an ultra-modern machine which will remove more metal at any speed than is possible on any other heavy duty lathes. Maximum production results because the machine can be kept under full load during the entire cutting cycle. Major contributing factors are more machine output per unit of power input, less operator effort, reduced maintenance and ease of supervision.

Performance reports from the field reveal production increases of 25% or more along with a like improvement in tool life. As always, invest in the best—the cheapest in the long run. The Series 80 includes two separate machines—two models for work requiring 25″-30″ clearance diameter, 16″-20″ swing over cross slide and three models for larger and heavier work in the range of 32″-40″ clearance diameter and 20″-28″ swing over cross slide.

These machines are big in size and even bigger in productivity—Ask for Booklet 1603.

THE MONARCH MACHINE TOOL COMPANY, SIDNEY, OHIO

PRODUCTIVITY



ELECTRICALS RIGHT WHERE THEY BELONG

1. External main drive motor mounting and external electrical control mounting (either NEMA or JIC) for quick accessibility.
2. Motor mounted on hydraulic system sump also supplies power for hydraulic pump.

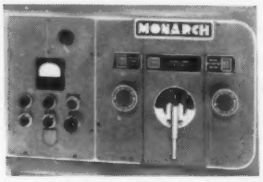
PROTECTED GEAR BOX AND END GEARING

1. Both the gear box and end gearing are totally enclosed. Lubrication is kept in, dirt kept out, original accuracy maintained.

SPECIAL INTERLOCKS—SAFETY FIRST

1. When machine is started, the brake engages automatically, preventing spindle rotation regardless of main control lever position.
2. No speed shift can be made with spindle rotating. More than anything else this preserves the original accuracy of headstock gearing.
3. Leadscrew and feed rod cannot be engaged simultaneously; neither can feed and power rapid traverse.

THE HEADSTOCK THAT THINKS



1. 36 speeds—range 10 to 1250 R.P.M. on some models, 8 to 1000 R.P.M. on other models—ratio 1 to 125. Standard range low enough, high enough, with plenty of speeds in between to provide reasonably constant surface cutting speed on most work.
2. Operator works in terms of surface cutting speed. Machine automatically figures correct R.P.M. and sets up shift. Operator sets two dials—one for work diameter, the other for desired surface speed. A speed indicator always shows the R.P.M. in engagement.
3. Flip of a lever gives free spindle in a jiffy. And there is a generous 3-1/16" or 3-9/16" hole through the spindle.
4. Hydraulic brake and clutch are self-adjusting for wear. Being under automatic machine control regardless of load, operator needs not supply power for engagement.

APRON—THE CONTROL CENTER OPERATORS GO FOR

1. Provided with four-way, hydraulic, variable speed power rapid traverse. Both carriage and cross slide traverse may be engaged simultaneously. Infinitely variable speed feature permits such extremely close control that manual handwheel traverse is virtually eliminated.
2. Apron and cross feed handwheels automatically disengage during traverse as a safety feature. A single jaw clutch in each mechanism causes feed pick-up at the same point after any traverse movement.
3. Positive, cam controlled feed frictions. Application is such that machine never loses its chip under the heaviest of cuts.
4. All controls located to permit operation from a stand-up position—no stooping or stretching necessary.

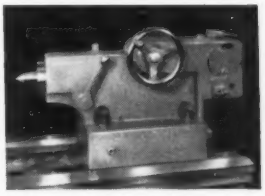
THE BED—SOLID AS GIBRALTER

1. All four bed ways flame hardened and precision ground to keep them factory-fresh for years to come.
2. Triangular bridge type girth construction provides stability needed for heavy duty work. Center section of bed designed in such a manner that chips automatically flow through openings in the rear to chip pan for extra-easy removal.
3. With chip pan set to rear and low work center height, operator can get conveniently near the spindle to change centers, chucks, work pieces and so forth.
4. Longer machines equipped with traveling rod supports which are automatically picked up and dropped off by apron.

EXTRA EQUIPMENT—EXTRA PRODUCTION

1. Additional equipment in considerable variety is available for the Series 80 line. Consider, by all means, the advantages of the "Air-Gage Tracer", a means by which thousands of users have reduced costs substantially.
2. Ask for descriptive Booklet 1603 which not only describes the basic machine but the commonly used items of additional equipment and includes full specifications.

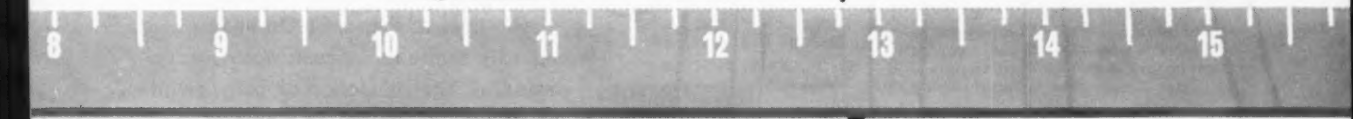
THIS TAILSTOCK MEANS BUSINESS



1. Either single speed or two speed range type available with dead or anti-friction center spindle. Sufficient mass, rigidity and spindle size (5-3/4" or 6-1/2" diameter) to support the heaviest of cuts.
2. Work piece expansion, due to heat, absorbed by heavy duty springs in tailstock.
3. Handwheel located at front for operator convenience when changing work pieces.
4. Movement along bed manually or by power. This combination satisfies all turning conditions.

COMPLETE AUTOMATIC LUBRICATION

1. Headstock, end gearing and gear box served by single system of the filtered, combination mist-splash type.
2. Apron lubrication system of the circuited, metered and filtered type also provides oil to carriage guide ways and cross slide bearings. There is ample lubrication during both power and manual longitudinal and cross feed.
3. Tailstock has its own lubrication system.



MACHINE CONTROL—THE EASY WAY

1. Series 80 controlled by a three-position lever at the apron. A duplicate lever close to the headstock is provided for setup purposes. With this lever, work rotation may be started or stopped and jogging may be accomplished.
2. Shifting, an operation performed many times each day, is at fingertouch ease and speed. Hydraulic power does the work of clutching, braking, gear shifting and jogging.

SUPERVISION IN A JIFFY

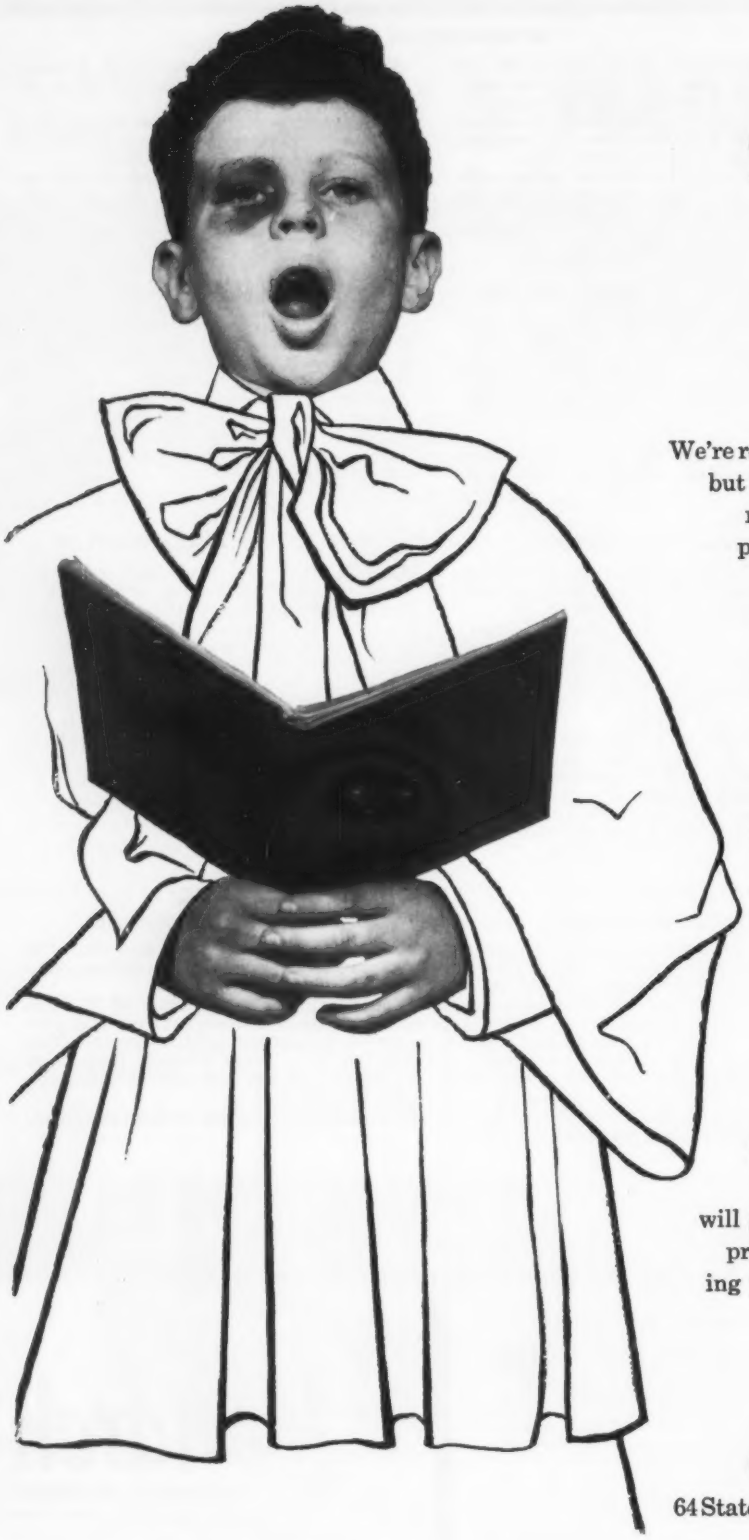
1. At a quick glance, supervisor may check (a) work diameter setting, (b) S.F.P.M. setting and (c) H.P. consumption. This makes it possible easily and quickly for him to assure full productiveness of the machine and the operator at all times.

Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH



Ten-year-olds really shine on Sunday

We're referring not only to juvenile cyclones, but also to those 10-year-old (and older) machine tools that are undermining production efficiency in plants everywhere. On Sunday your machines are idle – and it's the only day of the week the old ones are not losing money for you. Chances are that a performance comparison of your present surface grinding equipment with modern Blanchard grinders will open your eyes. Because unless your plant is an exception, it's safe to say that *your* surface grinders are obsolescent . . . are penalizing your production efficiency every working day. Find out how modern Blanchard grinders, equipped with Blanchard wheels, can boost production, improve quality and cut costs for *you!* Your Blanchard distributor is an expert in the field of grinding. On request he will gladly make an honest, accurate appraisal of the efficiency of your grinding production. Write or phone today.

BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 State Street, Cambridge 39, Massachusetts

For more data, circle page number of this ad on inquiry card

PRODUCTION POINTERS from GISHOLT

More cost-cutting IDEAS– to help you

CHAPMAN VALVE SAVES 155 MINUTES ON CHECK VALVES

Improves quality...cuts costs and maintenance of form tools

Here's a way to save time and money by applying new thinking to old jobs. With this setup on a new Gisholt MASTERLINE 2L Saddle Type Turret Lathe, The Chapman Valve Manufacturing Co., Indian Orchard, Mass., saves an average of 155 minutes on each of 4 sizes of cast carbon steel tilting disc check valve bodies.

Special equipment includes a reduced feed selective gear box, a "tenth" dial indicator and longitudinal feed dial for the cross-feeding hex turret plus a fixed, 25°-angle cam in the cross-feeding turret taper attachment.

Here's the sequence on a typical 6″ valve body:

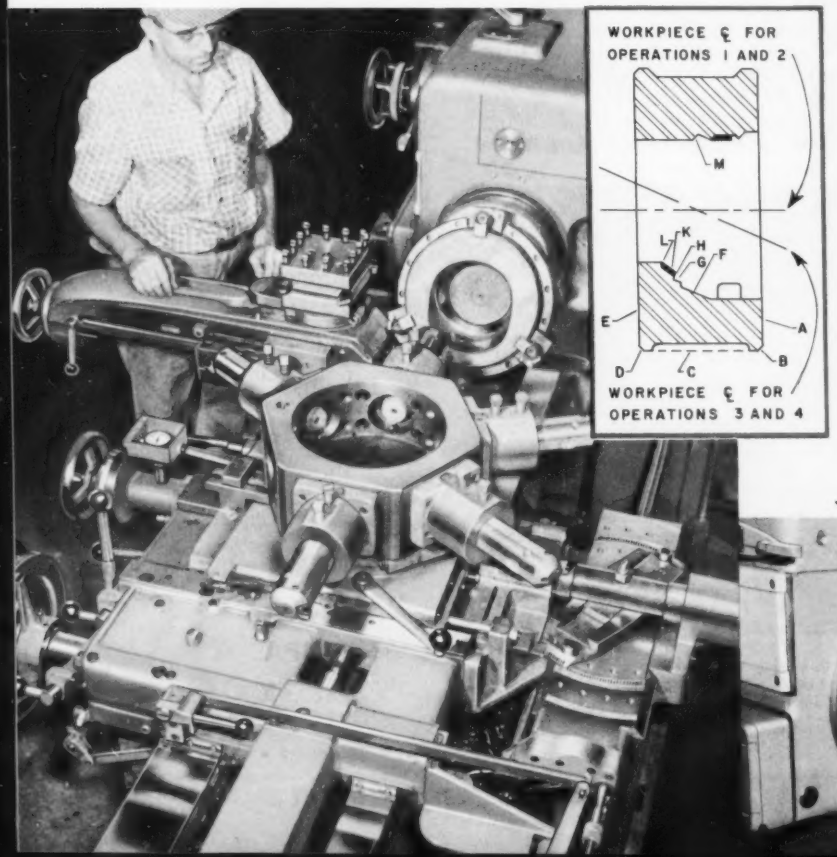
Operation 1—Chuck at C, locate at E in 18″, three-jaw air chuck. Face A, chamfer B and turn C to chuck jaws. Time, 43.0 min. f.t.f.

Operation 2—Using same chuck, locate at A, hold at C. Face E, chamfer D and finish-turn C. Time, 31.0 min. f.t.f.

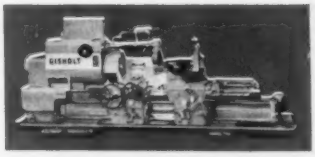
(In these two roughing operations, ½″ stock is removed on diameter and ⅜″ per side on facing. Hex and square turrets are used simultaneously wherever possible to save time.)

Operation 3—The part is placed in a counterbalanced, angle fixture. It is oriented to a scribed mark on the fixture, located against surfaces C-E and hand-clamped at A. The longitudinal feed dial and "tenth" indicator are used to speed positioning as hex turret tools rough- and finish-bore surfaces F-G-K-L-M. The 25° fixed cam in the taper attachment assures accuracy and rigidity on surfaces K-L. Time, 24.2 minutes, f.t.f.

Operation 4—The stainless steel valve seats are inserted in a separate operation. Then back to the 2L, where the same fixture and holding method as in Oper. 3 is used for finishing the seats. Only hex turret tools are used as surfaces F-G-M are remachined to remove welding flash. The stainless steel valve seat is faced at H and taperbored at K, using the dial indicator to hold the close tolerance in the bore. Time, 34.8 min. f.t.f.

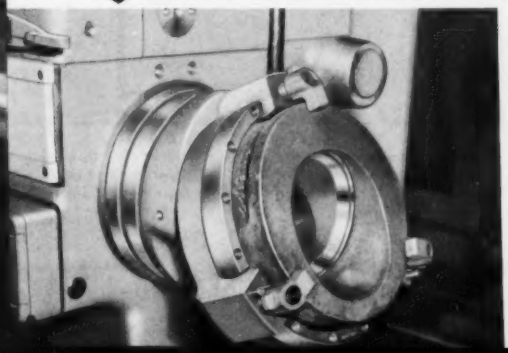


One new machine saves 155 minutes machining time per part, replaces two older units. New tooling method eliminates cost and maintenance of form tools. Reduced feed gear box for seat boring provides 32 micro-inch finish. Additional savings are derived through reduction in lapping time.



Tooling for Operation 4. Note dial indicator at left and 25°-fixed-angle cam in taper attachment at right. Low-cost standard carbide tools on cross-feeding hex turret replace expensive form tools previously used.

Close-up of workpiece after Operation 4 and fixture. Drawing shows surfaces machined.



STANDARD MACHINE INCREASES PRODUCTION 250%

Avoids cost of special machine with smart chucking, compact tooling

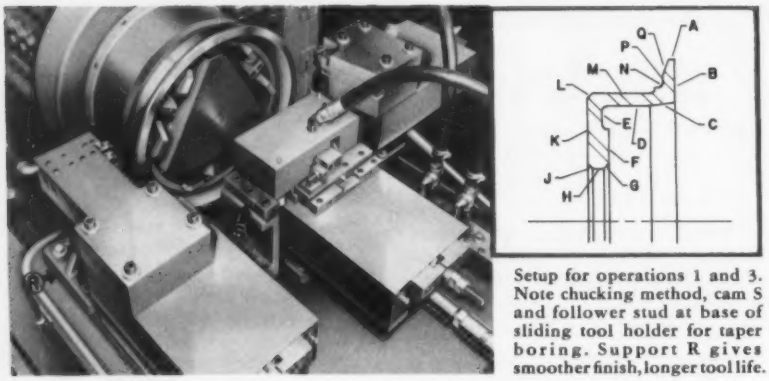
Here several tooling tricks are revealed in the way 20½″-diameter, 2″-wide steel brake ring forgings are machined. Two Gisholt Simplimatic Automatic Lathes replace older machines, increasing production from four to ten parts per hour.

For operations 1 and 3 on the first machine, distortion of forgings is avoided by locating against K in a drawback fixture, centralizing on three pins in bore H. Three clamps, with two swivel fingers on each, hold at six points on web F. Front slide tools rough-turn M-A with extra support from bracket R. Center slide tools rough-bore D, undercut E, and rear slide tools straddle-face P-B. Total time, 3.6 minutes f.t.f.

A similar fixture is used for operations 2 and 4 on the second machine. Work locates against B, centralizes on a chucking ring at D, and clamps at P. In operation 2, front slide tools rough-bore H, and rear slide tools straddle-face K and F in 4.6 min. f.t.f.

In operation 3, a sliding tool holder in the center slide tool block follows tapered cam on bracket S, to generate 15° angle C, finish-bore D, finish-form E, chamfer G. Front slide tools finish-turn M-N-A, chamfer L. Rear slide tools finish-face P-B, chamfer Q in 3.6 minutes f.t.f.

During operation 4, front slide tools finish-bore H, chamfer J; rear slide tools finish K-F in 4.6 minutes f.t.f.



Setup for operations 1 and 3. Note chucking method, cam S and follower stud at base of sliding tool holder for taper boring. Support R gives smoother finish, longer tool life.

Centralizing pins or chucking ring and six-point clamping eliminate chucking pressure distortion and improve accuracy, concentricity and parallelism. Sliding tool block locks in place for straight boring or follows cam S to generate accurate taper.

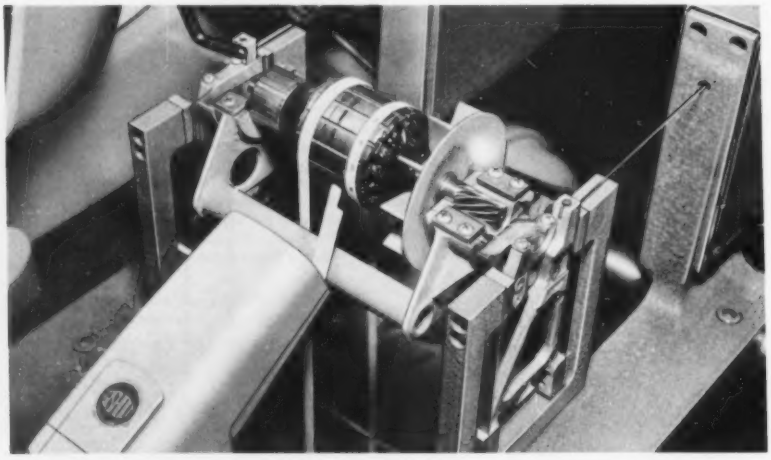
HOW BALANCING IMPROVES QUALITY AT AMERICAN ELECTRIC MOTORS, INC.

Setup eliminates guesswork on high-speed parts

You may find ideas in this 1S Balancer setup to help you improve your products. It's doing just that for American Electric Motors, Inc., a subsidiary of American-Lincoln Corp., Toledo, Ohio.

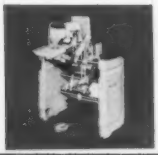
The workpiece shown is an armature, fan and drive gear assembly for a hand power saw and operates at speeds up to 10,000 r.p.m. Accurate balancing is a "must" for vibration-free operation and long service life. A cradle fixture is used to hold the work between the balancer supports. Although this increases the parasitic weight, the balancer's electrical system permits virtually infinite amplification of unbalance vibrations and accuracy is not impaired.

As the part is rotated, the operator notes the angle and amount of unbalance in each correction plane. The direct reading amount meter is calibrated in terms of the specific correction method used for each plane. This eliminates computation by the operator. The assembly is removed and the left end corrected by inserting slugs between the laminations. These are pre-cut and sorted by weight in handy trays for quick selection. The right end is corrected by a punch that removes the indicated amount of metal from the fan blade edge. Production is 25 parts per hour at 80% efficiency. This includes measurement, location, correction and inspection.



Cradle fixture permits this high-speed assembly to be supported on its own bearings even though the right-hand bearing journal is "hidden." Pre-cut metal correction strips, sorted by weight, save added time, minimize chance of operator error.

Gisholt balancing saves time, improves product quality because direct reading amount meter and strobe angle indicator permit finding exact angle and exact amount of unbalance the first time... eliminate all operator "guessing."



ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT

SUPERFINISH LENGTHENS LIFE OF AMERICAN RADIAL DRILL COLUMNS

Low-cost method to reduce abrasion—increases life of column and sleeve

MASTERLINE GISHOLT SINCE 1887

Compare this low-cost, quality-boosting technique with your present operation. Take a good look at the column on this radial drill, manufactured by The American Tool Works Company, Cincinnati, Ohio. It's Superfinished to expose the tough base metal for extra wear life—and smoother operation.

A Gisholt No. 4 Superfinishing Attachment is used, mounted on the carriage of a 40″ American Pacemaker Lathe. Carriage mounting provides longitudinal feed for the entire length of the workpiece. The part shown is 75″ long and 15″ in diameter. In only four hours floor-to-floor time, the ground surface is reduced from 32 to 4 micro-inches R.M.S.

Columns for the entire line of American Hole Wizard Radials are now Superfinished, using this simple, low-cost setup. Column lengths range from 46″ to over 100″ and diameters range from 9″ to 19″. Multiple stone holders permit Superfinishing over the keyways without difficulty. The "mirror" finish on the columns is achieved with a *controlled* diameter reduction of less than .001″.

Superfinishing minimizes lubrication problems and surface wear. Attachment costs considerably less than finish-grinding equipment—yet does the same job. And your lathe can be used for other work.

Low-cost Gisholt No. 4 Superfinishing Attachment mounts on lathe carriage... handles a complete range of column sizes.

All American Hole Wizard Radial Drills now feature Superfinished columns. This assures easier operation and longer life—a real sales point in today's competitive market.

GEAR FORGINGS MACHINED IN JUST ONE MINUTE

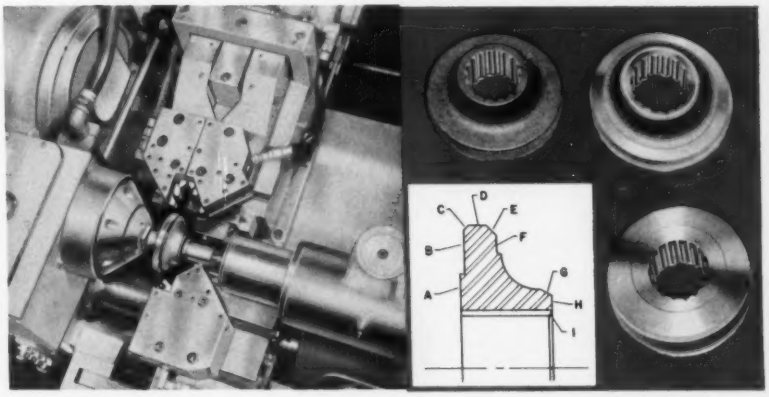
Smart setup includes arbor, loading cradle and straddle tooling

Here's how this tractor manufacturer makes simplicity pay big dividends—not only in time saved, but in improved quality. The parts are steel gear forgings—handled on a Gisholt No. 12 Automatic Production Lathe.

The part shown is $5\frac{7}{16}$″ in diameter, $1\frac{25}{32}$″ wide, with a spline broached in the I.D. The part is pressed in place on a supporting arbor and is located longitudinally in a fixture on the arbor press. This is done while another part is being machined.

The square end of the supporting arbor is centered and driven in a spindle-mounted fixture. To speed safe loading, a simple V-block loading cradle supports the other end while it is being picked up by the tailstock center. Front carriage tools turn D, chamfer G-I. At the same time, tools on the rear independent slide straddle-face B-F, A-H and chamfer C-E. A simple hydraulic arrangement moves the two rear slide tool blocks together for machining and apart for tool relief. Total f.t.f. time, just 1.0 minute.

Supporting arbor, loading cradle, straddle-facing tool blocks with hydraulic tool relief permit fast, accurate machining of front and back surfaces in one automatic cycle.



Overhead view of tooling and workpiece. Note square end of supporting arbor in work driver. Straddle-facing tools on rear blocks move together for machining, apart for tool relief.

Workpiece showing rough part and surfaces machined, front and back.

MACHINES WITH NEW MACHINE GUARANTEE

GISHOLT

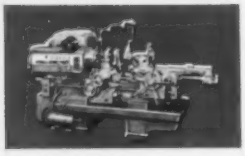
MASTERLINE GISHOLT SINCE 1887

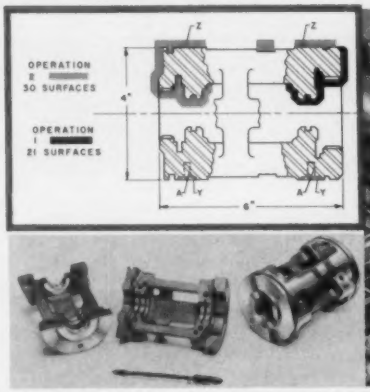
AIRESEARCH SLASHES TIME 35% ON CARRIER ASSEMBLIES

Hydraulic drive permits one operator to run two machines

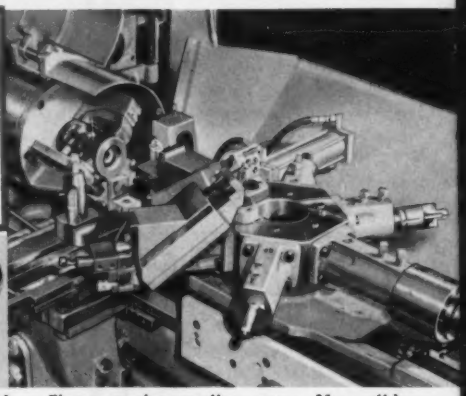
Here's proof that a small added investment in automatic controls pays big dividends. Study this setup used at AiResearch's Industrial Division plant in Los Angeles, Calif. It cuts machining time 35%, doubles operator productivity and improves accuracy on cast semisteel bearing carrier assemblies.

Two Gisholt MASTERLINE No. 3 Ram Type Turret Lathes are used. Hydraulic drive units provide automatic cycle operation. Spindle speed and feed changes, turret indexing and all tool operations are automatic, including work done from the cross slide. Forming, grooving and backfacing for both the first and second operations are handled by turret-mounted slide tools. On forward feed the movable slides engage a dead-stop cam on the cross slide and are actuated by continued forward movement of the turret ram. Reverse traverse provides automatic turret relief.





Workpiece consists of two sections, bolted for machining. Left—two halves, opened to show internal surfaces machined. Right—assembled to show external work.



First-operation tooling setup. Note slide tools operated by dead-stop cam at center of cross slide. Collapsing tap at right is recocked by cam block at rear of turret ram.

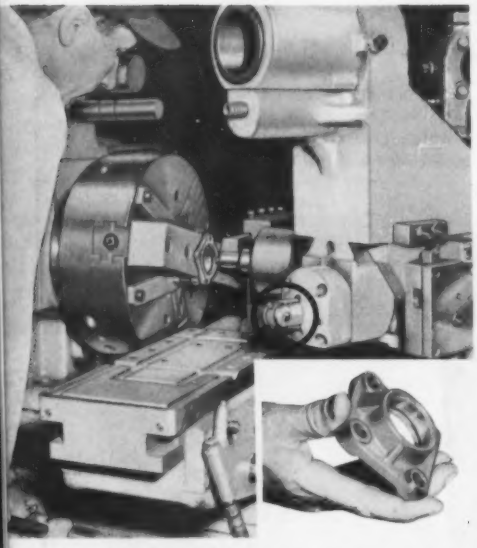
Parts consist of two mating sections bolted together. For the first operation, work locates on pins A against milled faces Y, on a fixed base. A swivel jaw holds at two points Z. Hex turret and cross-slide tools machine the 21 surfaces shown in black, including threading of the large bore, in only 2.5 minutes f.t.f.

Work then goes on the second machine. It is screwed on a threaded, drawback plug, locating against the machined face. The 30 surfaces shown in gray are finished from the hex turret and cross slide. Again, this includes threading of the large bore. Time, 4.35 minutes f.t.f.

Hand-operated machine with hydraulic drive becomes cost-cutting automatic. Operator simply loads, unloads and starts new cycle. Handles two units, inspects and stacks work.

HOW UNITED STEEL CORPORATION, LTD., CUTS COSTS ON PILLOW BLOCKS

Double-tooled Fastermatic and spherical boring tool speed production

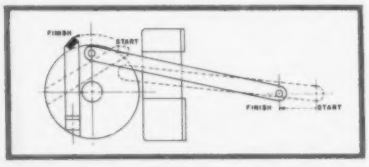


Pillow block in two-jaw fixture and spherical boring tool (encircled). Inset, part showing surfaces machined in two-minute cycle.

Here's a real time-saving setup for generating spherical bores in shell-molded pillow blocks to a .0005″ accuracy. United Steel Corporation, Ltd., Toronto, Canada, is using it on a Gisholt 2F Fastermatic Automatic Turret Lathe.

The work is held in a two-jaw fixture—one jaw stationary for location, the other movable for chucking. It is bored through from hex 1. A slide tool on hex 2 forms a grease groove in the bore.

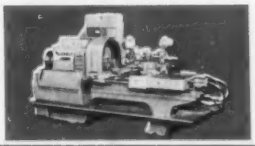
The top, movable portion of the slide tool on hex 3 carries the spherical boring tool and holder (encircled). The boring tool is linked to the slide base mounted on the turret face. On forward feed, the slide top engages a stop. The boring tool remains in a fixed position in relation to the work, while the slide base feeds forward, rotating the tool, generating the spherical bore (see drawing). A duplicate set of tools on stations 4, 5 and 6 finishes two parts with each turret index. Time, on a $2\frac{7}{16}$″ pillow block, 2.0 min. f.t.f.



Link attached to slide base feeds toward spindle, forces spherical boring tool holder to rotate, generating spherical bore.

Six boring heads handle ten parts, ranging from ½″ to $2\frac{15}{16}$″. The tool in each head is set to gauge for various diameters within its range.

Single-point spherical boring improves accuracy and finish. Double-tooled turret permits longer runs between tool changes, saves time of indexing past idle stations.



No. 11-1258
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The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Printed in U.S.A.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

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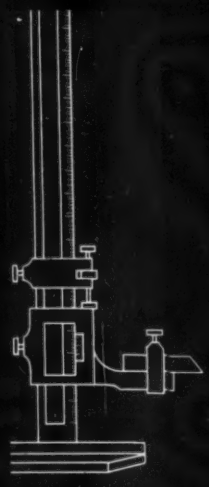

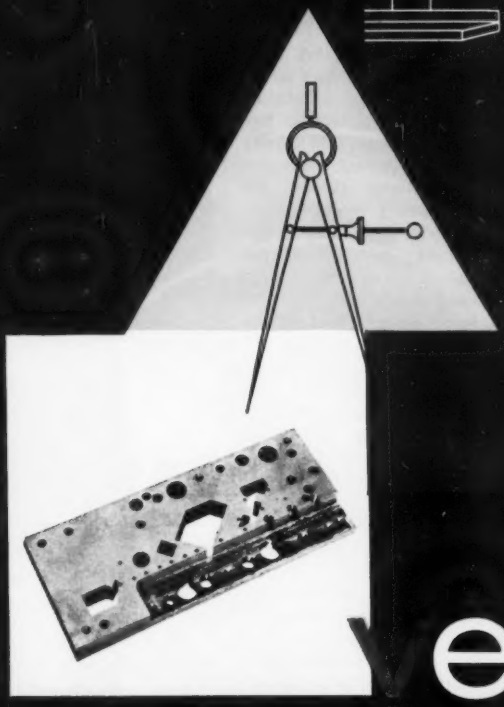

Vega

air-hardening tool and die steel offers safety in hardening unmatched in the industry. Even intricate dies with many cutouts, sharp corners and thin sections come through heat treatment with outstanding freedom from warpage and size change. VEGA is a tough steel specially developed by Carpenter to combine the machining properties of an oil-hardening grade with the safety in hardening of an air-hardening steel. On job after job, VEGA has outperformed any other grade ever tried! Order today from your nearby Carpenter SERVICE-CENTER.

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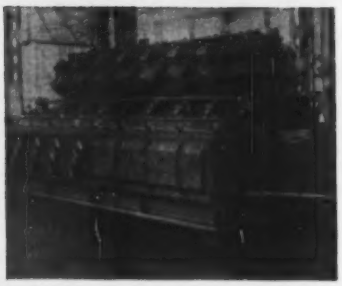
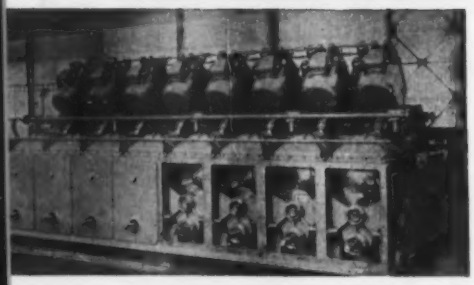
INNOCENTI

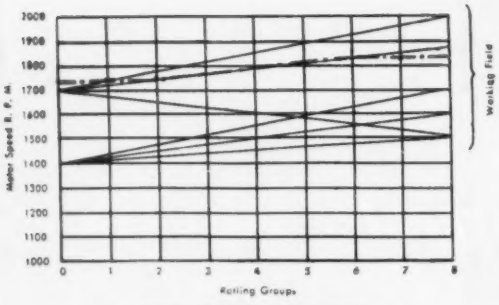
Stretch





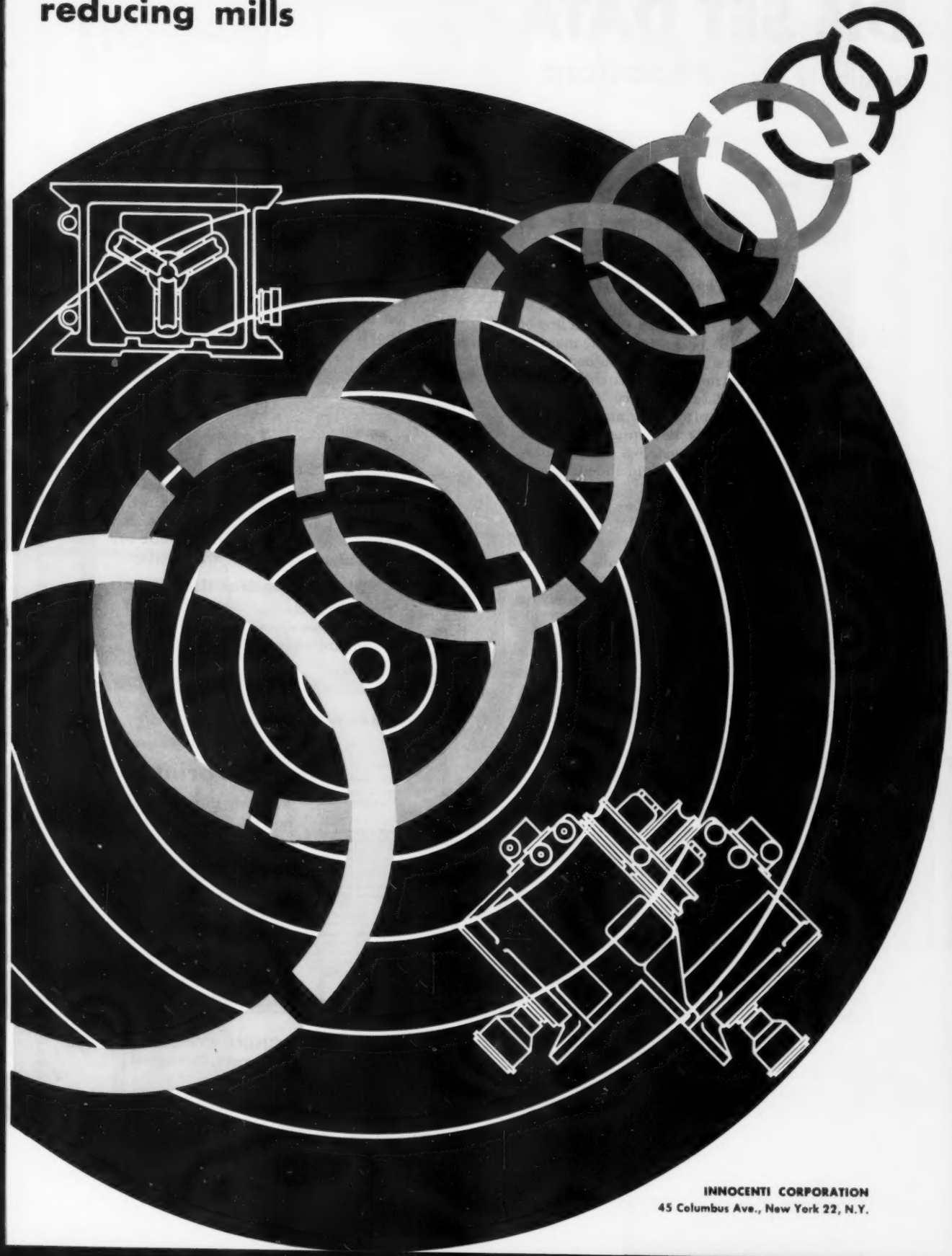
Works in Milan (Italy)

Stretch reducing Mills for seamless and welded tubes production; equipped with two Roll or three Roll stands. Direct current independent motor driving for two stand working unit Electric speed regulation allows variation of the speed curve into a large field even with the mill in operation. Inlet section can be reduced of 6-7 times. Simultaneously thickness reduction can reach the minimum commercial value. Both types of mills are available equipped with number of stands ranging from 12 to 25 according to the producing programs Semi automatic device for quick replacement of stands. Special lathes for cylinder contour rectification. **Using stretch reducing mill it is possible to produce the whole commercial standard of tubes from 3/8". Feeding into the mill welded or seamless, large diameter or high thick-**



ness tubes, the production average of your plant can be doubled.

reducing mills



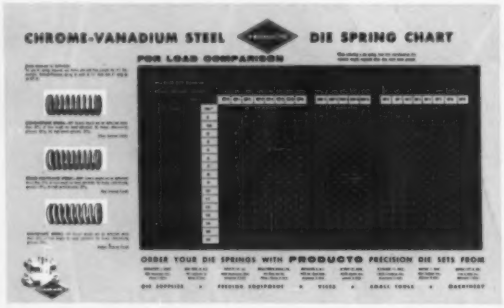
INNOCENTI CORPORATION
45 Columbus Ave., New York 22, N.Y.

DIE SET DATA

available from **PRODUCTO**

Die Set Catalog No. 11

This easy-to-use general catalog contains compact, complete listings and illustrations of Producto's broad line of die sets and die makers' accessories. There's a separate price book with *net* prices. A unique new binding enables you to have the technical data and price information side-by-side—no flipping back and forth required. *Color* spotlights key information and speeds up your use of the catalog. Many important new accessory items are included. Free.*

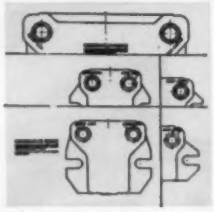

CHROME-VANADIUM STEEL
DIE SPRING CHART
FOR LOAD COMPARISON
ORDER YOUR DIE SPRINGS WITH PRODUCTO PRECISION DIE SETS FROM

Die Spring Comparison Chart

Die spring selection is simplified by this 12″ x 20″ chart in two colors, suitable for wall mounting. Convenient for use at the drawing board, bench or in the stockroom. Covers all three series of Producto chrome-vanadium die springs: Medium-pressure 50% deflection, Medium high-pressure 37% deflection, and High-pressure 30% deflection. Free.*

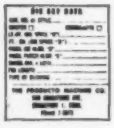
Die Set Digest

Every issue of this 8-page quarterly publication is packed with valuable hints for designers, manufacturers and users of dies. Hard-to-find information is presented clearly in the *Digest:* "Die Set Maintenance in the Pressroom"; "How to Select and Use Die Springs"; "How to Lubricate for Longer Life". Write and ask to receive *Die Set Digest* regularly. No charge.*



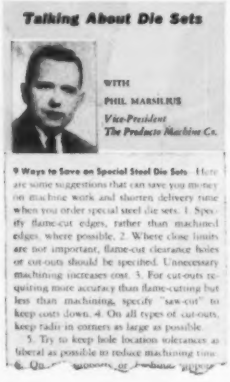
Die Set Templates

Accurate full-size templates for Producto rear-pin die sets. Save time and simplify layout for the busy die designer. $3.50 set. Write today.



Die Set Specification Stamp

Rubber stamp for tracings, prints. Provides spaces for die set ordering information. Free.*



Ad Reprints

Valuable die set know-how is provided in recent "Talking About Die Sets" columns: *How to Save on Steel Specials, Steel vs. Semi-steel,* and others. Send for complete file, free.*

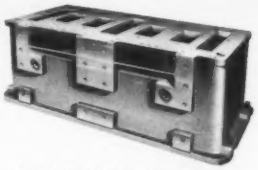
*WRITE TODAY for these useful and informative diemaking aids. Requests on company letterheads will be filled promptly.

THE PRODUCTO MACHINE COMPANY
985 Housatonic Avenue, Bridgeport 1, Connecticut

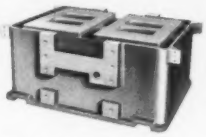
Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS



Double Wing Main Base



Single Wing Main Base

LAMB

STANDARD

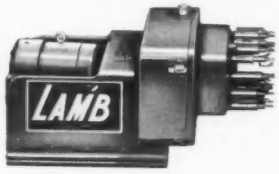
"Building Block"

COMPONENTS

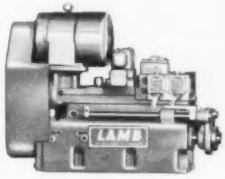
for

SPECIAL

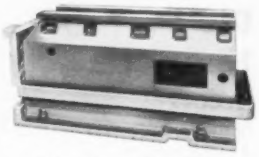
TRANSFER MACHINES



Way Type
Drilling Unit

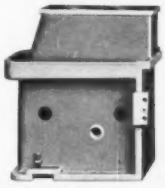


Quill Type Drilling
Unit—Hydraulic



Way Type Wing Base
18" Travel

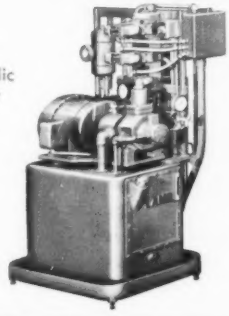
Wing Base
Quill Unit



Way Type Wing Base
24" Travel

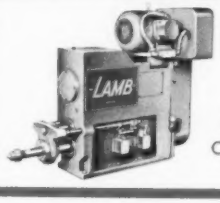
Angular Base
Quill Unit

Hydraulic
Power
Unit



Vertical
Column

Wing Base Adapter
(Radial)



Quill Type
Drilling Unit
Cam Operated

Lower Initial Cost

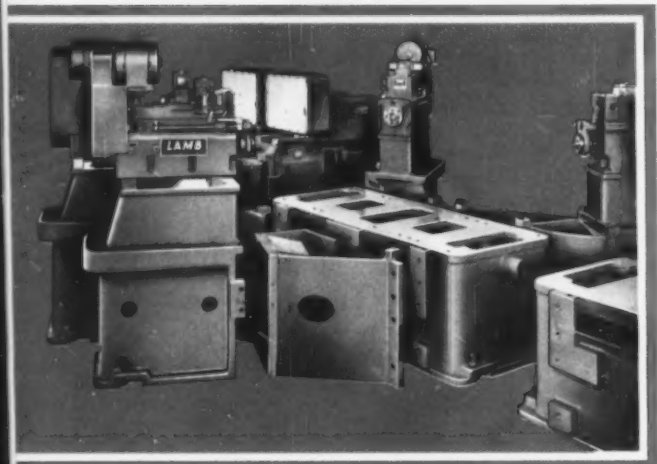
Lower Change-Over Cost

Greater Production Economy

Shorter Lead Time

Reusable Components

The LAMB Emblem of Excellence

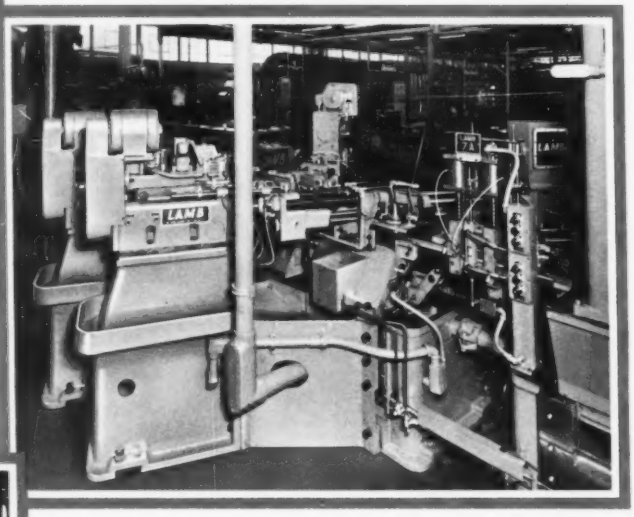


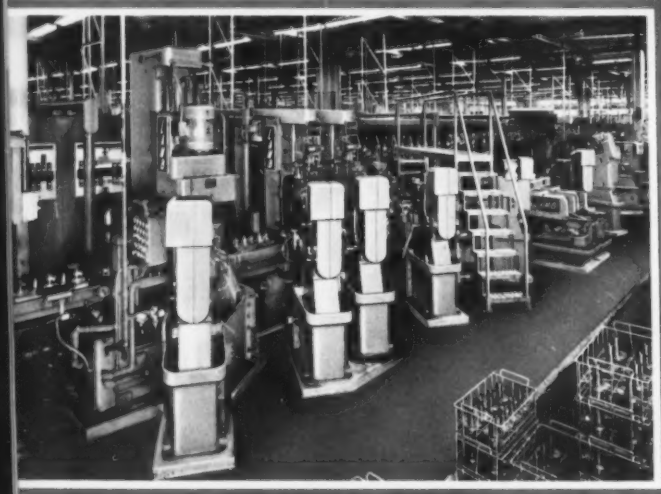
Standard Components Ready for Assembly

Experience has proved that the infinite number of combinations possible with Lamb standard components will satisfy practically all machining requirements. The standard components are manufactured in quantities which means substantial savings in cost and in machine delivery time. These components are designed also to provide ease of assembly and maximum interchangeability . . . resulting in important savings because they are not obsoleted by production changeover. For example, all main base mounting pads are machined although they are not all used . . . this means greater economy later should additional wing units be required for added operations.

The Completed Machine

Complete understanding of the customer's problems is one reason why the completed machine has received the customer's enthusiastic acceptance. Production economy is assured by Lamb's knowledge of high-production methods. Accuracy and reliability in parts movement, location, and metal cutting add to the assurance of high quality parts at low cost per piece.



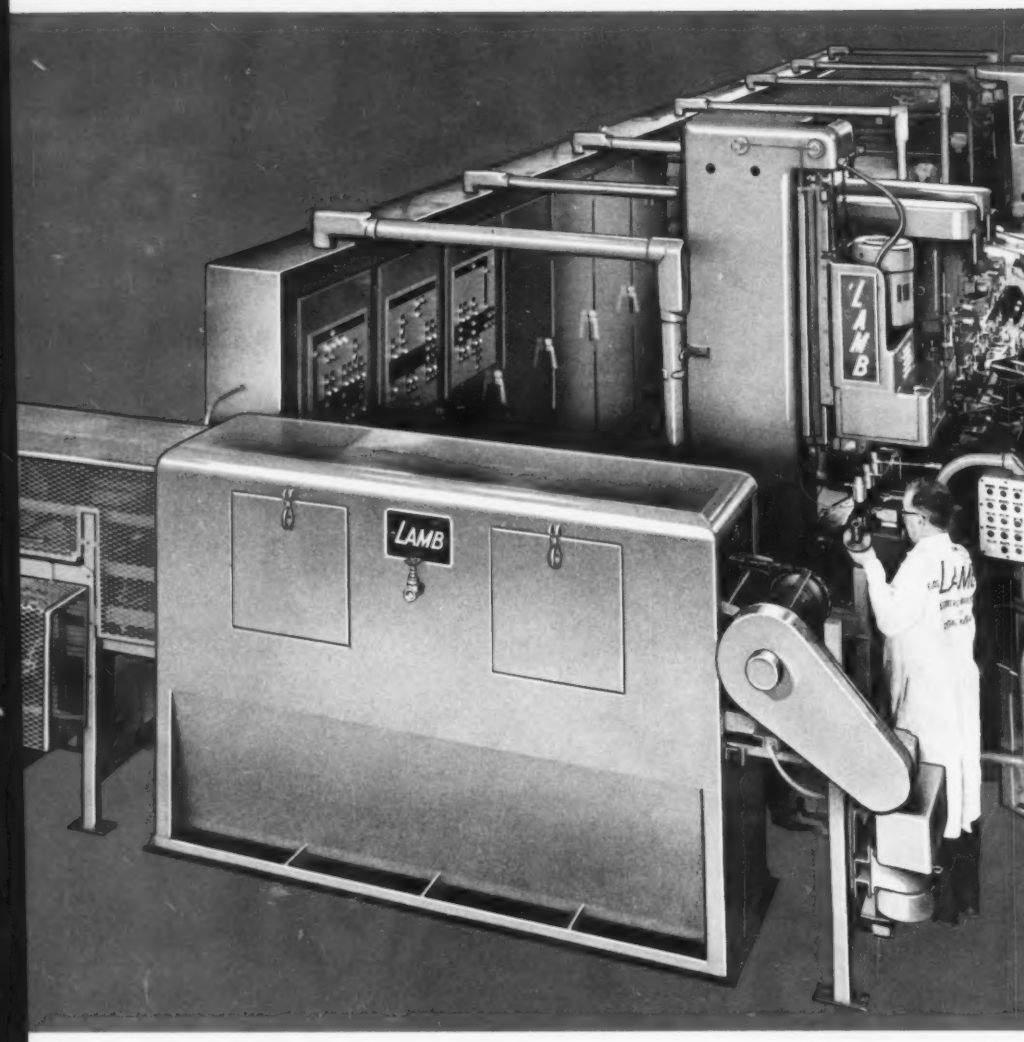


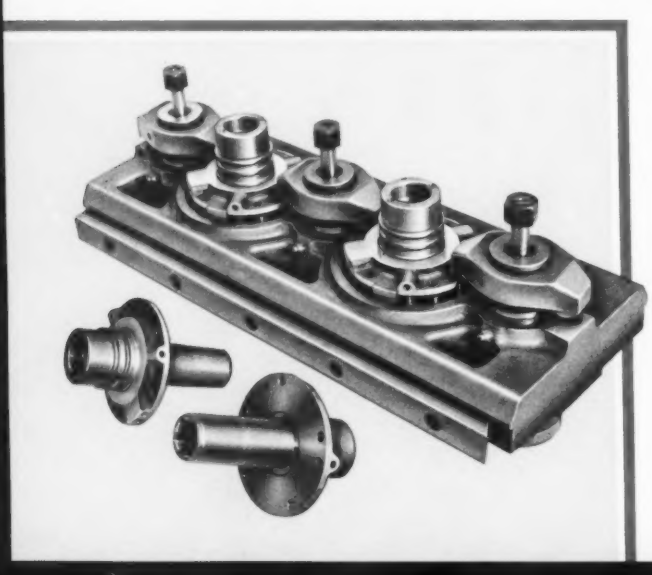
Easy Accessibility

Here is the Lamb machine installed in the customer's plant. It occupies a minimum of floor space yet provides adequate accessibility for quick tool change, adjustments and servicing. The machine configuration itself is thus a production convenience that promotes good housekeeping and overall efficiency. Tested and proved metalworking techniques are supplemented by Lamb's engineering initiative to overcome specific and critical problems.

Submit Your Part or Part Prints For Analysis and Suggestions

on Another Transfer Machine





334 Stator Supports I

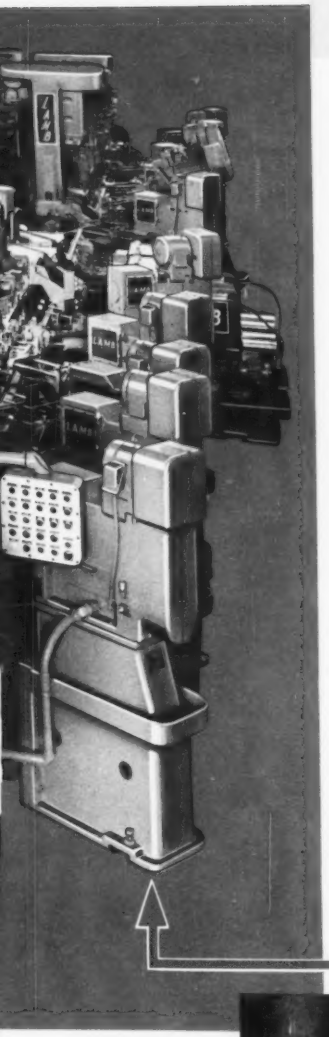
from this LAM

Palletized Transfer

Processing includes almost e
method of machining holes. T
carried in pallets (left) which a
station-to-station by a walkin
mechanism. Pallet clamping is
Each station is equipped wit
pins, and machining thrust i
pallet guide rails installed
tolerance with the pallet runn

Stator supports are machined
ferent angles and the pallet i
only twice to gain access to t
the parts.

HIGH PRODUCTION EFFICIENCY IS ASSURED . . . *because of* *LAMB'S Knowledge of Manufacturing Methods*

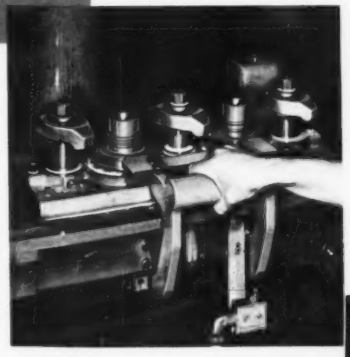


Well designed basic components combined with creative engineering are the ingredients found in every Lamb machine. Built-in production aids minimize the customer's in-plant problems and improve overall operating efficiency.

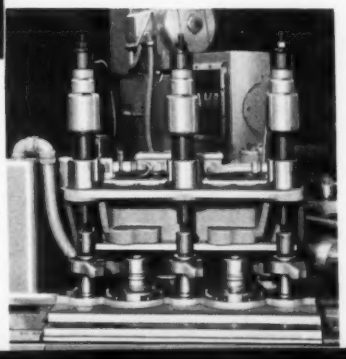
Listed below are some of the features included in the Stator Support Machine. They are indicative of the long experience, thorough planning and complete attention that Lamb engineers apply to every detail.

- Probing of all holes before reaming.
- Controlled acceleration and deceleration of transfer index and raise mechanism.
- Complete manifolding of hydraulic accessories to minimize piping and possibility of leakage . . . also for greater accessibility and faster servicing.
- Centralized automatic lubrication system; oil bath in self-contained units.
- Master electrical push button control at load station . . . pivots for right or left side operator position.
- Individual control buttons at all working units.
- Schematic light control panel indicates each station function or malfunction.
- Automatic clamp and unclamp of parts in pallets.
- Automatic pallet return and washer system.

From Loading to Unloading LAMB *provides* Production Convenience



Rough positioning device (left) at the operator's station assures accurate radial location of parts in pallet for positive automatic clamping. Handle trips a limit switch that otherwise prevents machine operation.



Automatic nut runners (right) speed unclamping of parts in pallet. Clamp dogs turn out of the way for easy part removal.

ts Per Hour

AMB

fer Machine

ost every known
es. The parts are
ich are transferred
alking beam type
ng is not required.
with registering
ust is against the
lled to precision
runners.

ined from six dif-
let is repositioned
to the bottom of

LAMB *Standard*

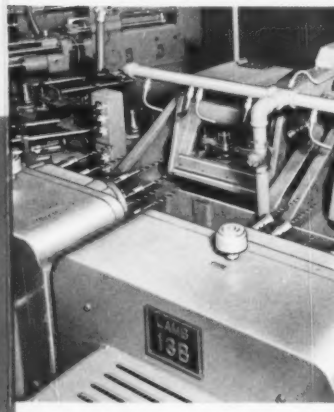
"BUILDING BLOCK" COMPONENTS

In Early Stages of

TRANSFER MACHINE ASSEMBLY

The Lamb "building block" principle is clearly illustrated here. The main base of the transfer machine is a series of standard sections each with integral chip chutes and recesses for readily accessible piping and electrical conduit. These sections support the fixtures and accessories; they have accurately machined mounting faces for attaching wing and column base units which are the working stations. This use of standard components represents the fulfillment of industry's demand for versatility and flexibility in processing equipment.

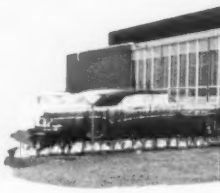
CREATIVE E



To perform operations entire pallet is rotated surface to the tools.

Probes Repla

A light spring-loade their bushings agains one limit switch is req ment which permits probing.

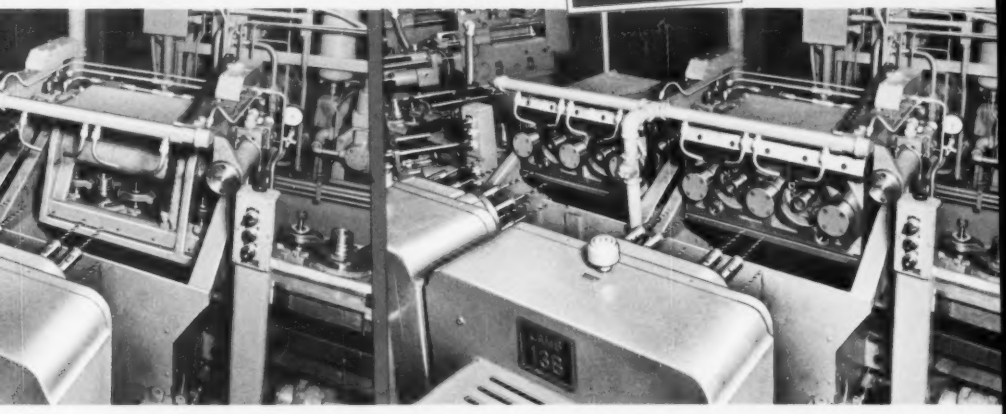


A comp in spec

F. JOS. L

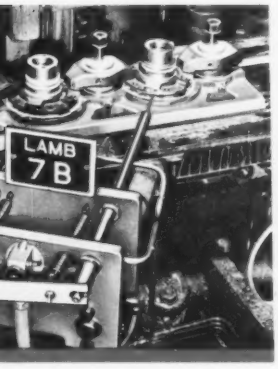
Engineers and

E ENGINEERING Identifies a LAMB MACHINE



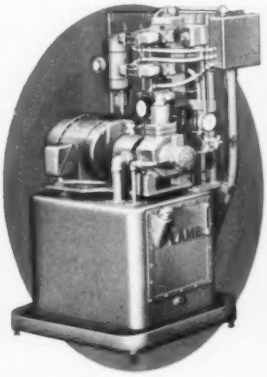
Pallet and Parts Repositioning at Work Station

tions on the bottom of the parts, the ated 90 degrees to present its bottom ols. With bushings inserted into the bottom of the pallet, it becomes a drill jig fixture. This technique eliminates subsequent handling to gain access to the bottom surface of the parts.



eplaced in Seconds

oaded bar holds probes in gainst a spacer plate. Only s required with this arrange- mits single or multiple hole



"Packaged" Hydraulics

Hydraulic power units are built to JIC Standards using nationally accepted components selected for service familiarity of maintenance personnel and replacement parts inventory economies.

Lamb Pallet Washer

Pallet handling and washing is completely automatic. Unloaded pallets are automatically transferred to a conveyor and returned to the load station after being washed; they are in position for loading and indexing into the machine.

completely equipped modern facility staffed by men who design and build the finest special and transfer type machines and automatic parts handling equipment.

8191

LAMB CO.

SINCE 1914

5663 E. NINE MILE ROAD • DETROIT 34, MICHIGAN

and Builders of Special Machines and Automation Equipment

LITHO IN U. S. A.

"Manning, Maxwell & Moore, Inc.
manufactures and sells to industry "Shaw-Box" Cranes and "Load Lifter" Hoists, "Ashcroft" Gauges, "Consolidated" and "Hancock" Valves, "American" and "American-Microsen" Instruments. These products are manufactured in six plants — five located in the United States and one in Canada.

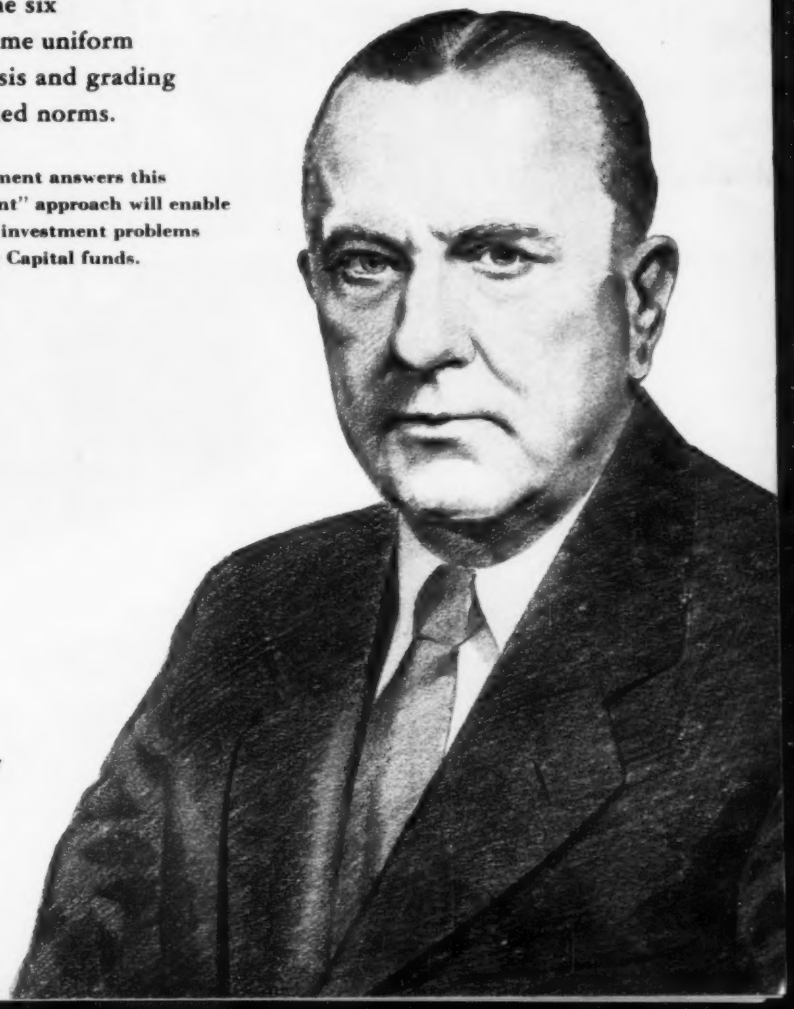
"These products are sold in highly competitive industrial markets. To improve or even to maintain a long term competitive position, it has been necessary to continuously review methods and equipment in an effort to combat the inflationary spiral caused by constantly rising labor and material costs. Cost reduction through modernization of methods and machinery is the keynote of our efforts.

"One of the ultimate responsibilities of the chief operating executive is the decision for the allocation of capital funds to provide best for the future needs of the business. The competing demands of the six plants of the company have required some uniform method of presentation to permit analysis and grading in accordance with previously established norms.

The MAPI Formula applied to facilities replacement answers this requirement and the new "Return on Investment" approach will enable us to apply the formula to a greater number of investment problems thus enhancing its value as a tool for allocating Capital funds.

"Lightening the Burden of Decision in Acquisition and Replacement of Machinery"

BY *J. ROBERT KELLEY*, PRES.
MANNING, MAXWELL & MOORE, INC.



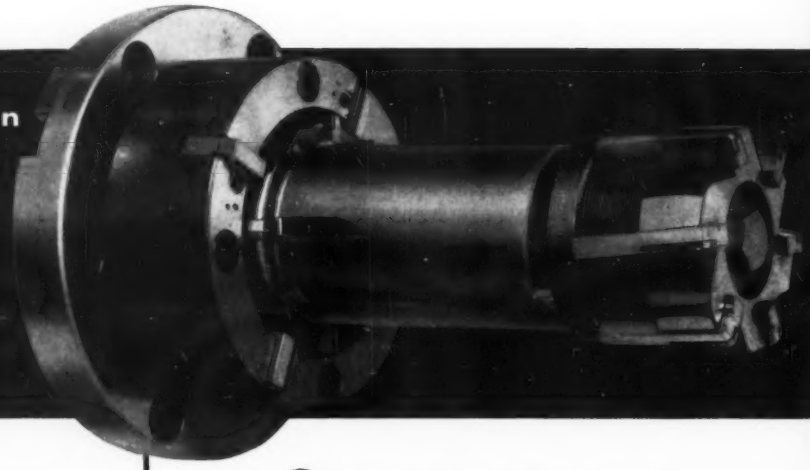
Rockford Insert Group

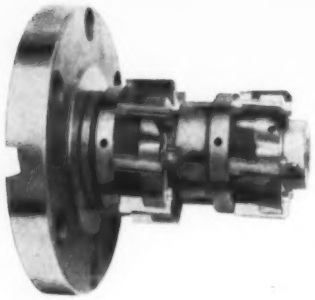
keep gathering metal-working production ideas . . . be well informed when you replace machinery.

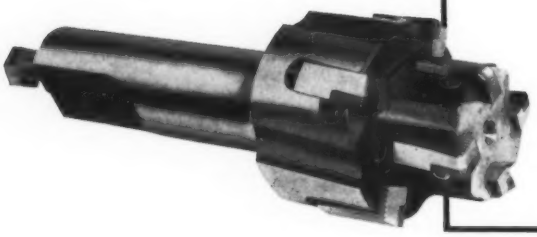
for high-production,
transfer-type machining...

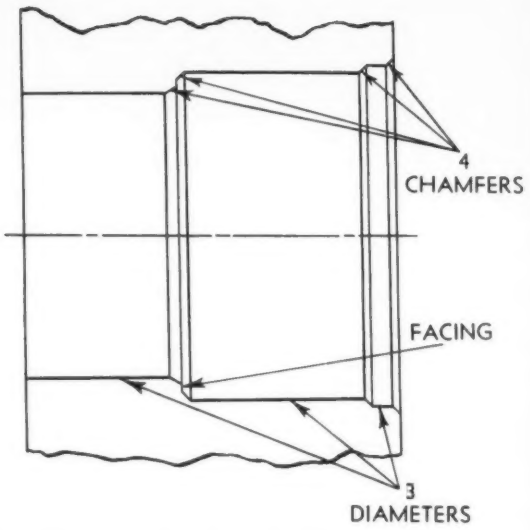
Barber-Colman

MULT-O TOOLS SAVE TOOLING COSTS!



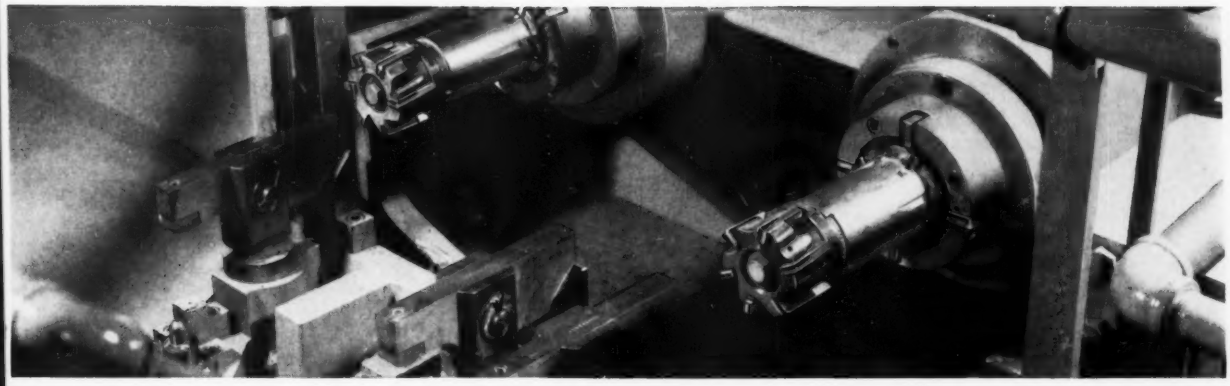






Eight surfaces cut by one MULT-O Tool

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



These Barber-Colman Mult-O Tools perform 34 machining operations on power steering housings which are processed on a 35-station Greenlee transfer machine. A total of nineteen tools ranging from .220" to 6.250" diameter combine multiple operations for facing, hollow milling, boring, reaming and chamfering.

In most cases, one tool performs several operations. The sample drawing shows the eight surfaces which are cut by one tool. There are four chamfering operations, one facing operation, and the tool reams three different diameters. All tools are designed to perform a maximum number of operations. This combination of operations results in a minimum number of spindles.

Most cutting edges are carbide tipped inserted blades. Carbide tips provide long tool life, and the inserted blades result in low tool cost since only the blades require replacement. Wherever possible, standard blades are used so that they can be obtained from stock. Conventional sharpening methods are used on all tools.

In designing high-production Mult-O Tools of this type, Barber-Colman Engineers consider chip load, finish required, and amount of stock to be removed for determining the number of blades in each tool. Holding means and type of blade mounting are designed to suit each particular application and size of tool.

On this job, machine designers supplied part prints, sequence of operations and production requirements. With this data, Barber-Colman Cutter Engineers designed tools to combine multiple operations for the most efficient results.

Mult-O Tools can also offer cost saving advantages for *your* production operations. If you use multiple operation, transfer-type machining in production, ask Barber-Colman Engineers for analysis and recommendations on cutting tools which produce maximum efficiency. Send part prints and production desired. A representative will be glad to discuss your requirements on request.

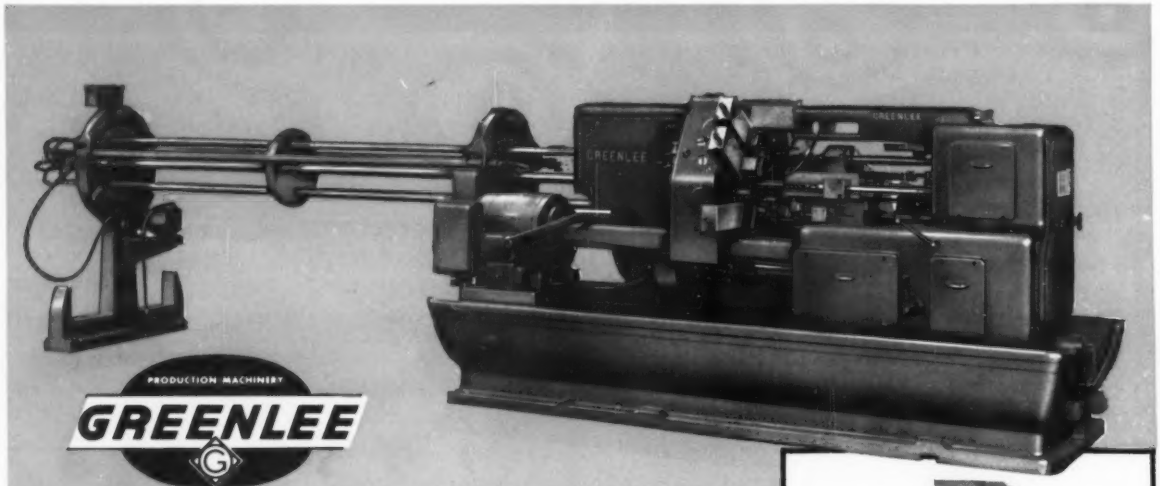
BARBER-COLMAN COMPANY

8212 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



PRODUCTION MACHINERY

GREENLEE

MULTIPLE FEED-OUTS...

A Natural

on Greenlee Air-Feed Automatics

Feed Out Stock to 16½"

Eliminate Pushers and Feed-Out Cams

Removable fittings attach air lines to the stock reel tubes. A vacuum pump withdraws the piston when restocking. Push-button control panel is provided for starting and stopping.

Greenlee Air-Feed Automatics offer you a 3-way profit advantage:

1. Maintenance and change-over time is reduced by eliminating stock pushers, feed tubes and feed-out cams.
2. Stock can be automatically air-fed to position in one or more machining stations permitting two or more pieces per cycle.
3. Multiple feed-out flexibility enables you to finish machine a variety of pieces that ordinarily demand costly second operation setups.

If you are running into production headaches on a specific job, Greenlee may be able to adapt an "Air-Feed" to solve your problem. See your Greenlee Distributor.

Write for your copy of Catalog A-405 — first step on the way to more profitable production with Greenlee Automatic Bar Machines.

Greenlee Standard and Special Machine Tools

Multiple-Spindle Drilling and Tapping Machines

Transfer-Type Processing Machines

Six and Four-Spindle Automatic Bar Machines

Hydro-Borer Precision Boring Machines

GREENLEE
BROS. & CO.

1872 MASON AVE.
ROCKFORD, ILL.

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Production time reduced 82% on new lathe

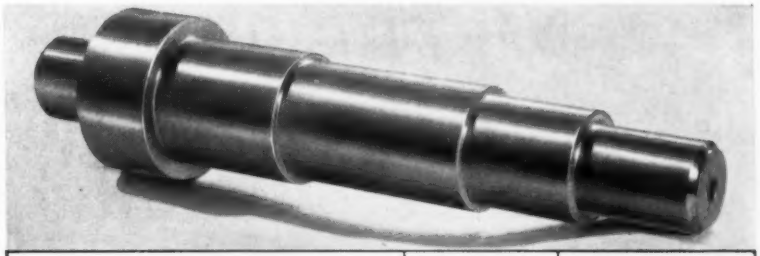
PROFIT POINT TURNING

New Barber-Colman 36-speed lathe does 13 operations on drive gear and shaft in 22.7 minutes

Turning time on the drive gear and shaft shown in the illustration was reduced from 126 minutes to 22.7 minutes when transferred from an old lathe to a new Barber-Colman 36-speed lathe.

The shaft is 15″ in length with a maximum diameter of 3.744″. Spindle speeds range from 644 rpm to 912 rpm, and the feed is .013″ per revolution. On the old lathe, speed was 350 rpm and the feed was .015″ per revolution. This is a good example of how machine horsepower, accuracy, rigidity, and operational features can reduce costs drastically.

Easy-to-set up Barber-Colman lathes combine power and precision for profitable optimum speed turning with negative-rake throwaway insert tools. They're heavier and wider through the carriage than most lathes of their size. Controls are "human engineered" to make a busy operator's job easier and more efficient. Yet they offer every toolroom feature you can name, plus guaranteed accuracy for precision work.



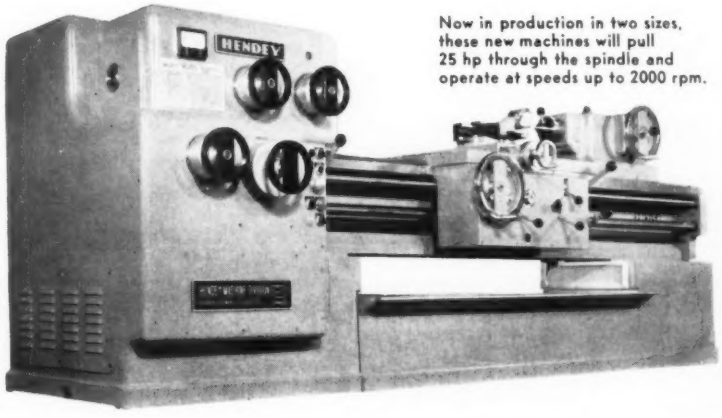
STANDARD TIME	OLD LATHE	NEW 36-SPEED LATHE
SETUP TIME (hours)	1.09	1.75
SPEEDS (rpm) FEED (inches per rev.)	350 .015	644 to 912 .013
PRODUCTION (per hour)	0.47	2.64

Opportunities in cost-cutting modernization

There'll never be a better time to buy a new lathe, or greater opportunities to reduce costs through equipment modernization. Here are two good reasons:

1. *Throwaway insert tools* are the biggest "break-through" in lathe "economics" in 30 years. Think of what it costs you to sharpen, change, and reset conventional tooling! Throwaway inserts make your perishable tool costs so low in relation to part costs and the cost of operating a machine, the only sensible thing to do is boost speeds, burn up tools faster, and reduce floor-to-floor time.

2. *It's the right time to buy machine tools*, because you can "pick and choose" — get the right machine and tooling for your assortment of jobs. The increase in productivity will prepare your plant for periods of high volume, spiraling costs, and labor shortages tomorrow.



Now in production in two sizes, these new machines will pull 25 hp through the spindle and operate at speeds up to 2000 rpm.

Barber-Colman Company
122 Loomis Street, Rockford, Illinois

Don't expect a day's work for a day's pay on yesterday's machine tools.

BARBER COLMAN

PRECISION LATHES

You get lowest turning costs per piece by combining "Engineered Production" with Sundstrand Automatic Lathes

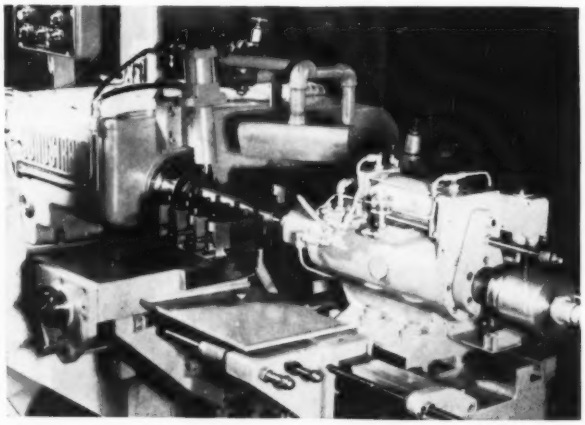
There's no better way to guarantee lowest piecepart costs and highest work quality than to provide the right combination of: 1. the best tooling method and, 2. best machine solution. Applying Sundstrand "Engineered Production" to your production turning job is the surest way to satisfy both these basic needs.

Whether your job calls for small lot, long run, tracer, or special turning, Sundstrand provides both a wide range of machines and attachments and extensive tooling experience resulting from numerous "Engineered Production" solutions. Only by combining both of these factors can you be sure that your job is being handled with maximum efficiency.

If your parts require turning, don't be satisfied with results until you compare the solution recommended by Sundstrand with present or comtemplated methods. Submit your part print or sample part, together with production requirements, to Sundstrand's engineering department for a quotation without obligation.

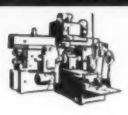
Small lot turning

Production increased from 30 to 106 pieces per hour on one of the twelve different sizes of plungers and liners when the job was put on this Model 8A lathe. Comparable savings were realized machining other sizes. Either three or four tools are used for turning, depending on part length.



SUNDSTRAND "Engineered Production" Service" REG. U.S. PAT. OFF.

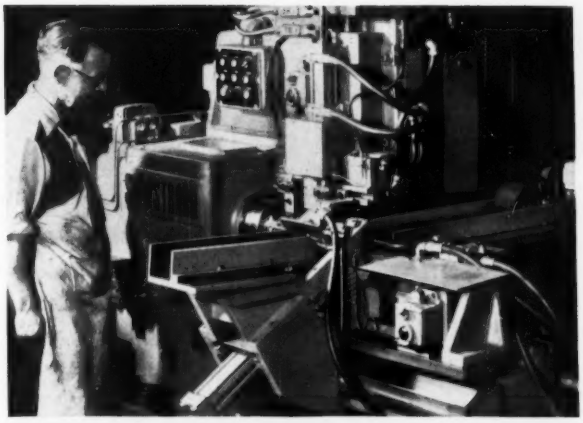
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS | TRIPLEX RIGIDMILS | SPECIAL MACHINES



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

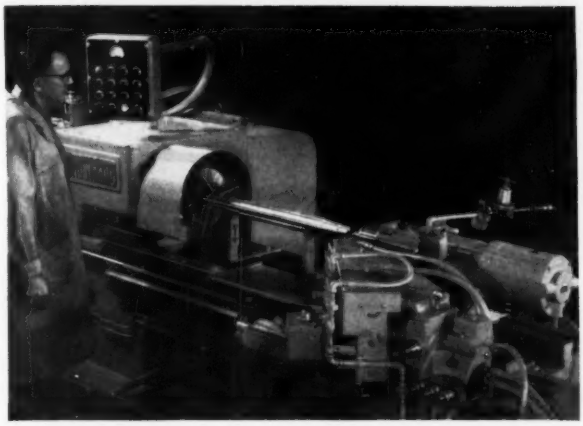
Long run turning

Facing and chamfering both ends of 240 stator shells per hour is handled on this Model 6A automatic lathe equipped with automatic work handling. A finger picks up the part from the inclined loading chute and positions it for spindle loading. Part is machined simultaneously on both ends and is ejected into chute.



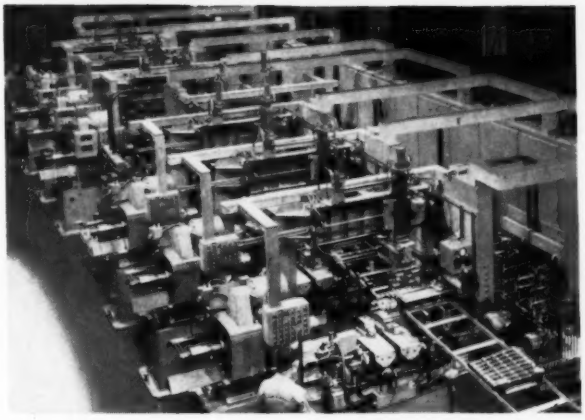
Tracer turning

Both ends of motor shafts are turned in a single Sundstrand tracer lathe with minimum parts-handling required. Operator simply turns part end for end at completion of first half of cycle, and indexes template to position for second half of cut. A variety of motor shaft sizes are handled by this single machine.



Special turning

When large-volume production of a single part dictates the use of special turning equipment, Sundstrand's experience makes a big difference both in initial investment and machining cost per piece. Here, eight automatic lathes connected by automatic handling equipment, turn out over 200 camshafts per hour using the latest in carbide and ceramic tools.



More Turning Facts on how Sundstrand "Engineered Production" and automatic lathes solved over 20 turning production problems. . . . write today for Bulletin 698.

SUNDSTRAND MACHINE TOOL CO.

2530 ELEVENTH ST., ROCKFORD, ILLINOIS

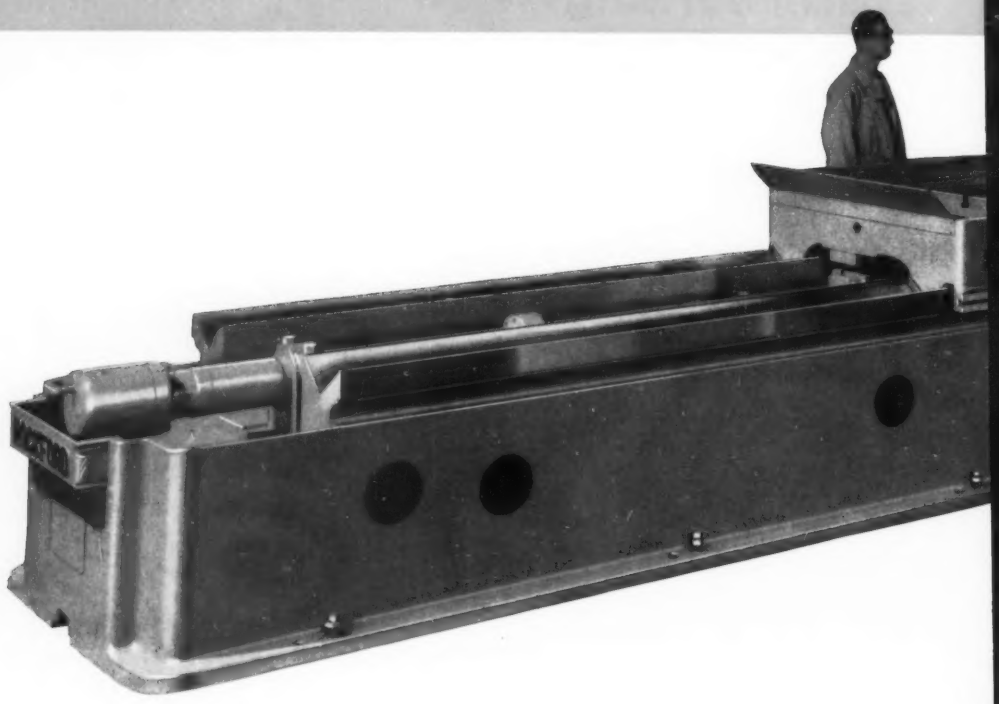
BROACHING TOOLS	THREE WAY	SINGLE RAM	HORIZONTAL	DUPLEX RAM	PRESSES

SUNDSTRAND "Engineered Production" Service"

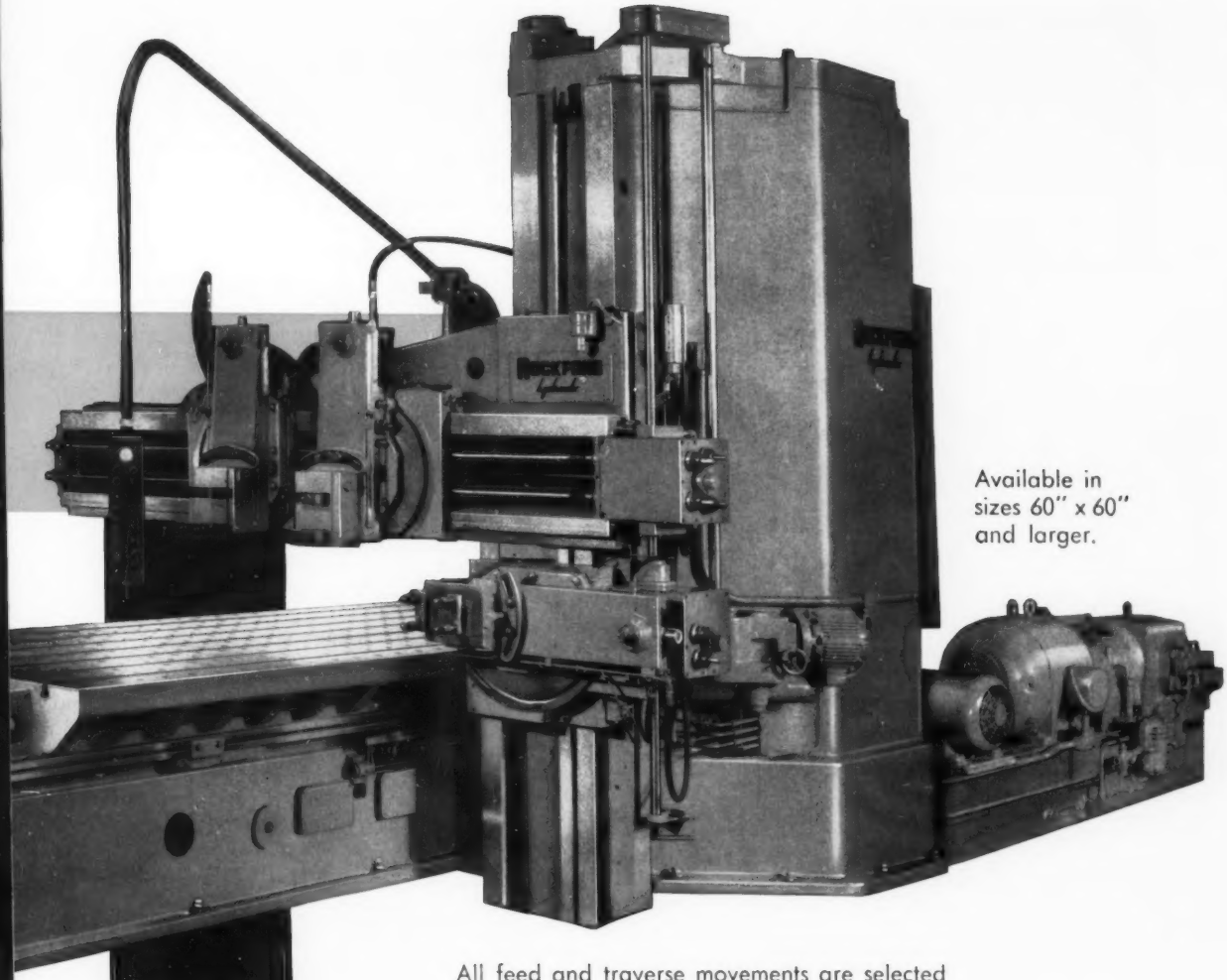
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

2-speed traverse motors eliminate manual positioning in set-up on

new Rockford Hydraulic Planer



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



Available in sizes 60" x 60" and larger.

complete pendant control speeds operation and set-up

All feed and traverse movements are selected and operated from the push button station of this new Rockford hydraulic planer. Two-speed traverse motors — high speed for approximate positioning, and slow speed for extremely close power positioning of rail and side heads — eliminate the need for manual positioning in setting-up for a job.

Extra-rugged construction affords use of most modern cutting tools and cutting techniques. The machine is equipped with the new high speed h3 triple circuit.

Get full details on the wide production flexibility of this new hydraulic planer from any Rockford Machine Tool Co. representative, or write directly to us.

h HYDRAULIC

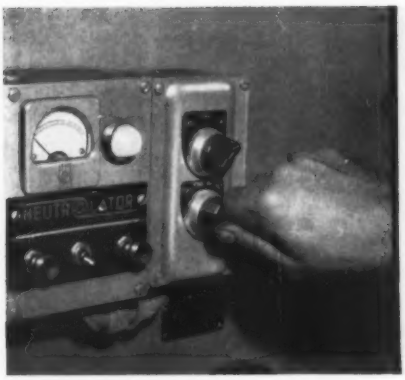
ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

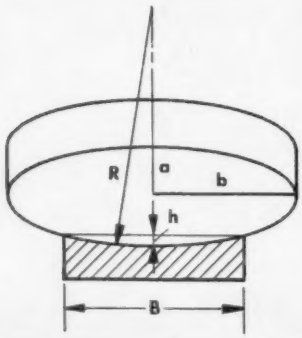
MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

New Quick-Tilt© Spindle on Mattison Rotaries

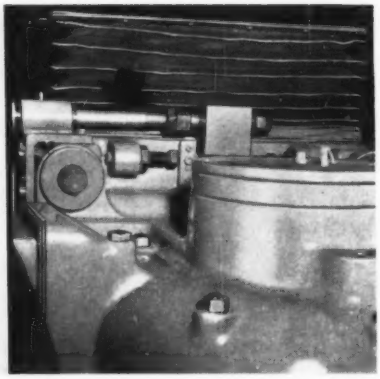
Flick-of-the-switch adjusts wheel clearance for consecutive roughing and finishing!



Spindle can be tilted or reset to perpendicular position in seconds by turning selector switch on the column at front of machine.



Power tilting solves the accuracy-efficiency paradox when grinding wide parts. Drawing shows error **h** when wheel is tilted at angle **a**.



Quick-Tilt© attachment at top of wheelhead automatically tilts spindle .010" toward leading edge of wheel.

Large surfaces can be ground faster, without curvature at minimum cost!

Now . . . your knottiest grinding problems can be solved.

This exclusive new Quick-Tilt© spindle converts a Mattison rotary surface grinder from a rougher to a finisher *in seconds*.

It is no longer necessary to compromise accuracy to get stock removal—or vice versa—you can get the maximum of both. Now spindle adjustments are so easy and automatic on a Mattison No. 24 or 36 rotary, it's faster to consecutively rough and finish practically any piecepart you grind—large or small.

Selector switch actuates power-tilting—no complex setup

A setup adjustment that once was so costly and time-consuming that many jobs were (and still are) done without taking advantage of machine capabilities, is now so simple it can be incorporated right into the grinding cycle. Turning a selector switch automatically tilts the spindle .010" toward the leading edge, or back to "dead flat." There are no bolts to tighten, no measurements to make, no cut-and-try methods for eliminating "wheel drag" or resetting the spindle for flat grinding.

Complex tilting adjustments offer no incentive for operators to realign the spindle so the low point of the wheel is always centered on the work. Yet, without a second grind using a flat wheel, maximum accuracy cannot be achieved without proper wheel setting. Quick-Tilt© assures that *on every job* you save time and increase accuracy by combining the advantages of rough and finish grinding.

Gives uniform accuracy and faster production of small parts

With the practical elimination of curvature, more small parts can be ground per machine cycle, job setups can be made faster and at lower cost because there's no need to center parts on the low point of the leading edge. Use the same, easily adjusted clearance for any job. Quick-Tilt© makes it practical to finish grind when necessary with the wheel set dead flat after roughing.

Think of the savings on large parts. You can hog off metal quickly and efficiently—up to 50% faster—without "wheel drag," loss of power, or heat build-up. Selection of wheels is not so critical. Only a light cut finishes the job and cleans up all concavity.

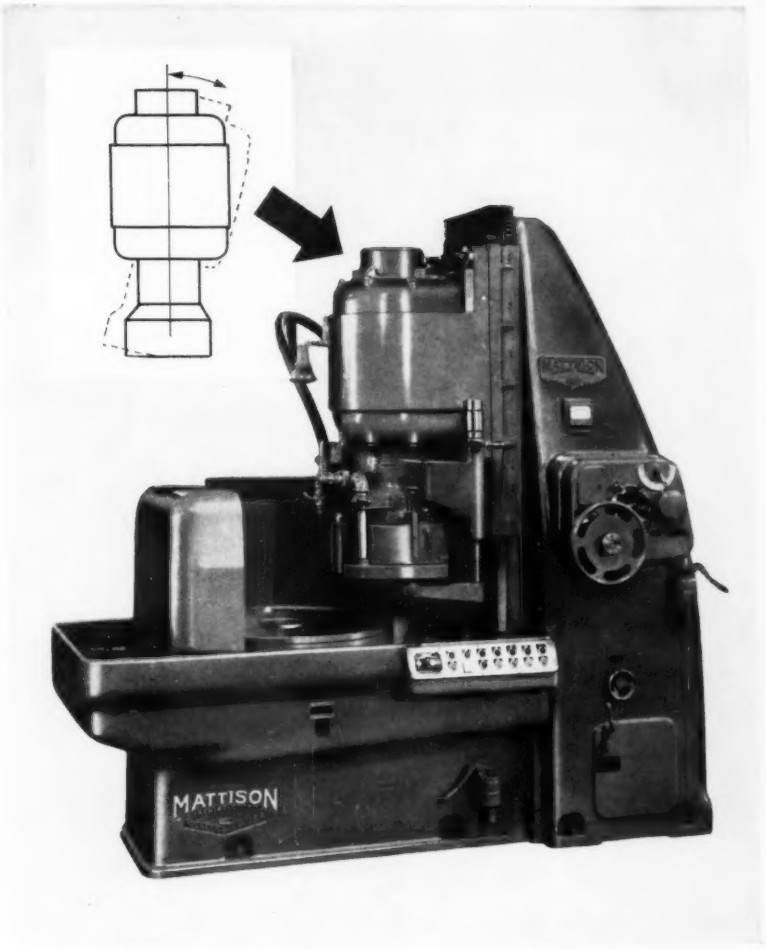
Increases stock removal

Mattison's exclusive wheelhead and column designs permit the inclusion of this low-cost power-tilting accessory and at the same time continue to offer the greatest rigidity, highest accuracy, and fastest stock removal capabilities. The massive, full-length column is bolted and keyed to the base, giving you rigidity equal to a one-piece bed casting. Widest, thickest, deepest "V" and flat ways eliminate cramping and permit fine-increment feeds for precision work. Standard Mattison No. 24's . . . with 18″ between the wheel and top of the chuck . . . are now being built with up to 60-hp spindle motors and a low feed range from .005″ to .042″ per minute. The high feed range is from .020″ to .165″ per minute. Downfeed is continuous—there's no limit to the feed ratio because of linkage actuation.

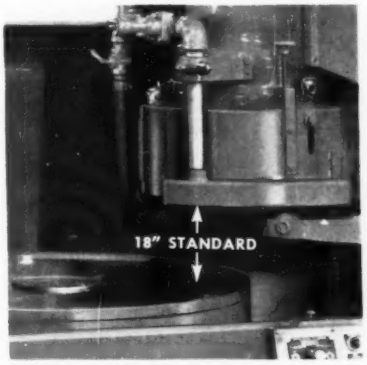
But, even more important, you can split the last increment of a ratchet-type feed on the Mattison, using automatic feedback through an electric or air-gaging system to control the grinding cycle automatically. You get controlled high production and quality, plus highest stock removal and work capacity. Stock removal may be preselected up to a maximum of .240″.

Other advantages are many

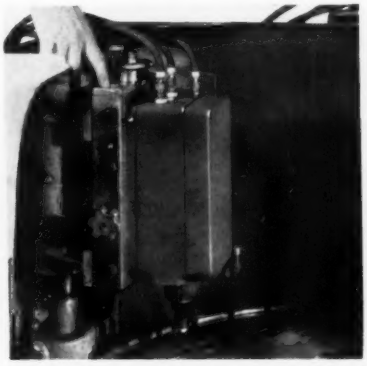
Heavy, cross-ribbed bed casting is not a coolant tank—temperature variations from this source cannot cause machine expansion and contraction. Accuracy can be controlled. Built from finest quality Meehanite metal, stress-relieved by heat-treating, the "No. 24" is designed for applying high unit pressures that assure positive cutting action, fast stock removal, and stress-free grinding. Large "V" and flat ways provide greatest weight-carrying surface for the table carriage. Bed ways are never exposed when the carriage is *in* or *out*. If you compare it by the pound, the "No. 24" weighs 17,000 lb net.



Quick-Tilt© solidifies all the accuracy and stock removal features built into Mattison rotaries. Stock removal can be increased up to 50% without sacrificing flatness. Standard No. 24's are being built with spindle motors up to 60 hp to provide optimum cutting efficiency.



Wider work range is yours on the Mattison No. 24 Vertical Rotary with standard 18″ clearance between table and chuck—up to 24″ available if required.



Optional automatic cycle is actuated by air or electric gaging system, which continuously measures work and provides visual indication that parts are approaching size.

Try before you buy

Send us your pieceparts and we'll grind to specifications on a machine equipped with a Quick-Tilt© spindle. There's no cost or obligation—your Mattison dealer will make the arrangements.

MATTISON MACHINE WORKS

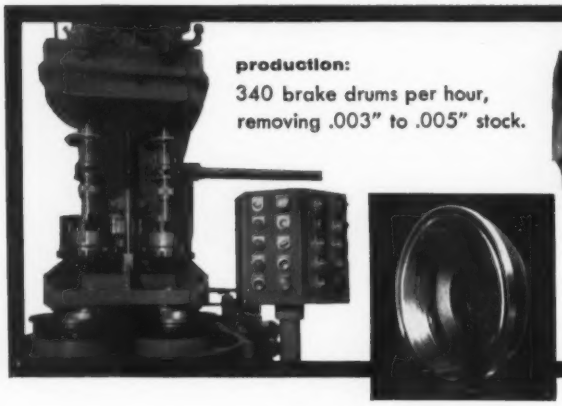
Rockford, Illinois • Phone: 2-5521

BARNESDRILL

special honing tool

answers unique finishing problem

- **removes taper**
- **corrects out-of-roundness**
- **applies selected finish**



production:
340 brake drums per hour, removing .003" to .005" stock.

BarnesdriL Special Blind-End Honing Tool with Adjusting Head utilizing Plas-T-Clad stones.

The honing tool that does all these things has been developed by BarnesdriL engineers, specifically for a brake drum manufacturer.

The drums represent a blind end bore of 11" in diameter and 2¼" deep. In order to reproduce the specified requirements, BarnesdriL engineers designed a special honing tool, Model HFB-8. This tool is a Special Blind End Lever type honing tool, utilizing eight clamp-type stones. The tool removes .003" to .005" stock from the sides of the brake drum. The finish is held between 80 and 100 RMS and the bore is honed diametrically straight.

Two of these tools are mounted on a 2-Spindle Ram Type Machine that provides a positive stop and dwell for blind end honing. Final production is 340 drums per hour.

custom-honing service for special short-run applications.

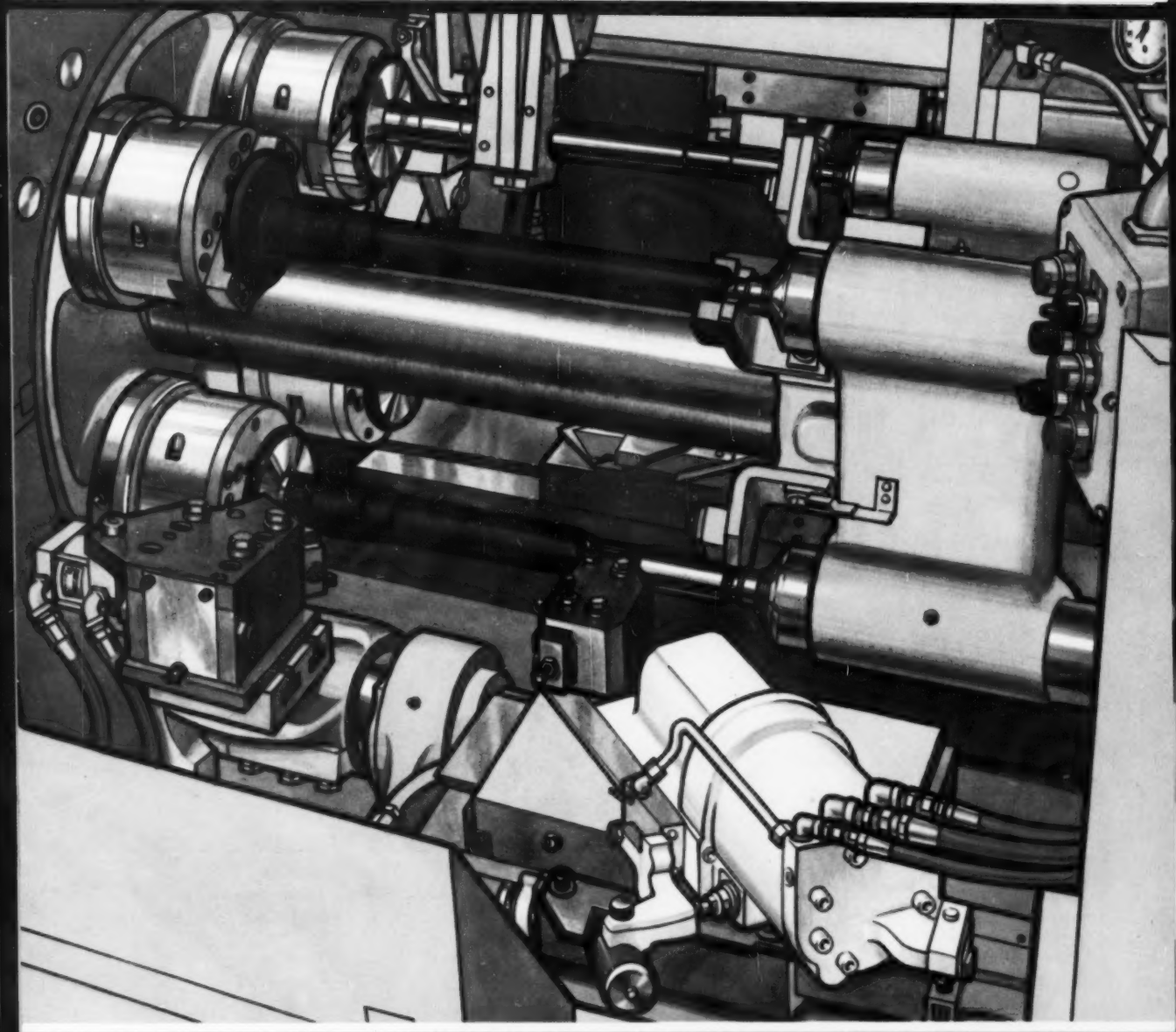
Send us your short-run pieces, with specs and finish requirements for prompt honing by expert technicians.

50th year

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 13121 Puritan Avenue

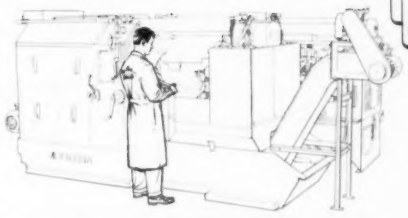
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



copy more than three times faster on

New Britain 4-spindle copying lathe

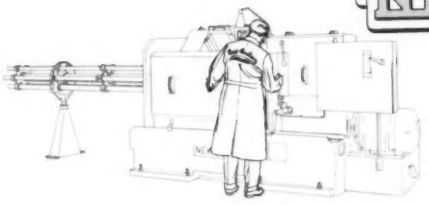
For the first time... multiple spindle copy turning. Loading station and three work stations. Work chucked between centers which index together. Template-controlled hydraulic slides perform copy turning; cross slides and/or forming arms perform a wide variety of additional operations. Two-speed spindles, automatic loading and unloading, and automatic chip conveyor optional. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Model 412/25 Copying Lathe

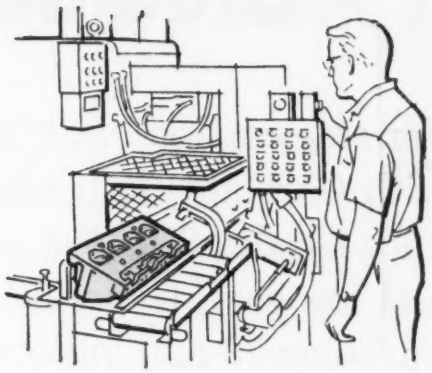
New Britain's new bar machines permit unlimited tooling combinations

An independent cross slide for every spindle means more operations with simpler tools and attachments. Three size ranges: Model 52 with 1¼" capacity and model 62 with 1⅝" or 2¼". Pick-off change gears permit a wide range of spindle speeds, as low as 117 r.p.m. (62 series) and as high as 4249 r.p.m. (52 series) for maximum production efficiency. Readily accessible tooling area and cross slide cams permit faster changeover. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

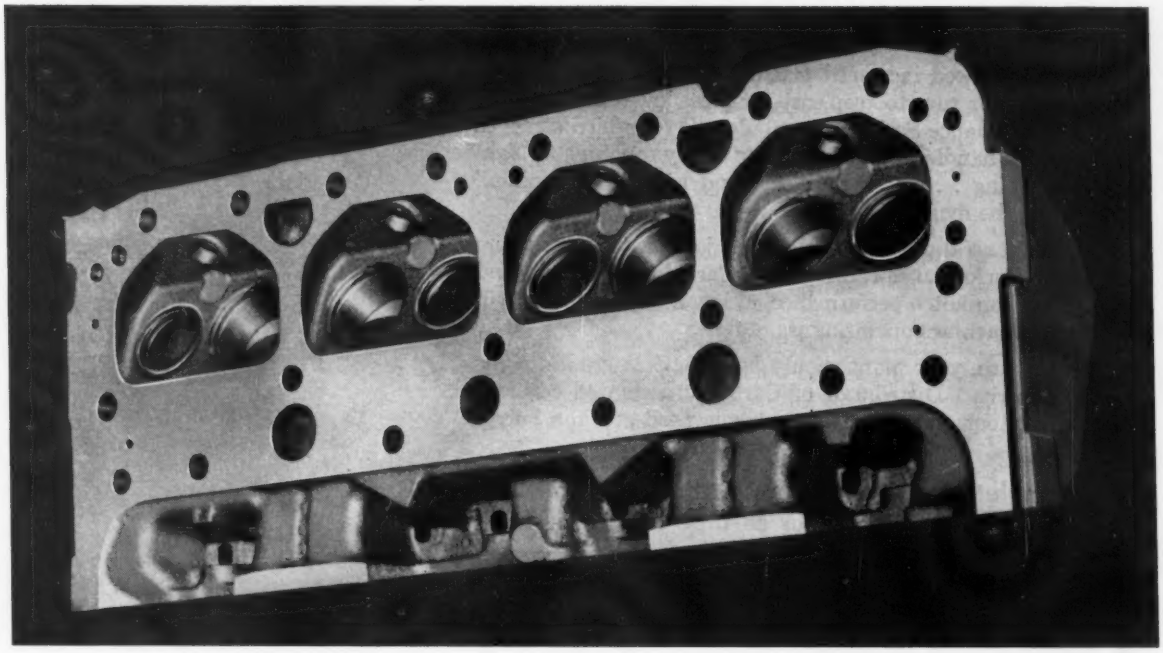


Automatic Bar Machine

TOCCO* Hardening of Exhaust Valve Seats



Saves Cost of Expensive Alloy Inserts



• *In just 12.5 seconds* the four valve seats on this heavy-duty truck cylinder head are heated to 1650°F. An area of 3/32" perpendicular to the valve seat is hardened to a minimum of 42 Rockwell C. TOCCO's uniform, localized hardening permits the elimination of costly alloy inserts. The cost of induction hardening is a small fraction of the cost of these alloy inserts.

This unusual application indicates the wide scope of cost-saving possibilities available through the educated use of TOCCO Induction Heating. If your products require hardening, heating for forming or brazing, it's better than an even bet that TOCCO Engineers can save you money.

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today — **NEW FREE Bulletin**

The Ohio Crankshaft Co. • Dept. M-12, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____

For more data, circle page number of this ad on inquiry card

LOOKING FOR MORE FROM

For steelcutting . . . trim costs with Carboloy® Extra-Performance Grades 330, 350, and 370, and low-cost, General-Purpose Carboloy 78 and 78B carbides

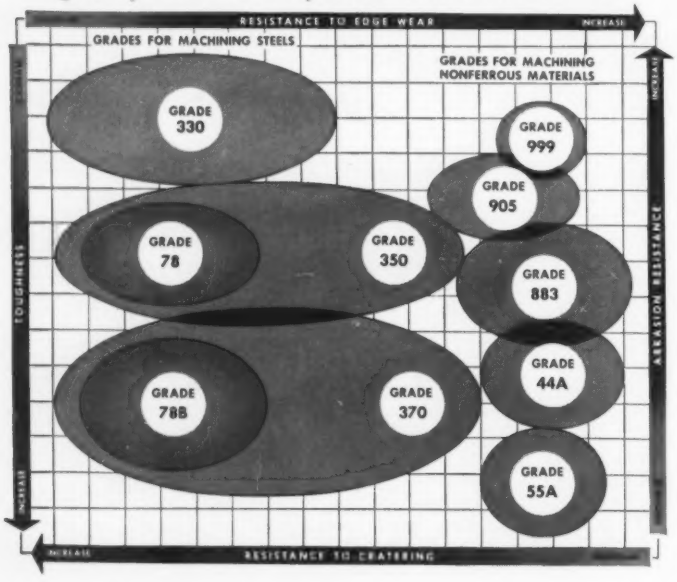
Some steelcutting jobs call for extra-tough, extra-performance carbides. Others can only be handled profitably with low-cost, general-purpose carbides. That's why we make them *both*.

Where you need increased machine productivity and have long production runs to keep cost-per-piece low—use Carboloy Extra-Performance Series 300 carbides. Their added strength and stamina handle jobs ranging from heavy roughing to high-speed finishing . . . at a unit cost and rate no "premium" carbide on the market can beat.

But, for general-purpose steelcutting jobs that don't require the Extra-Performance carbides, use Carboloy Grades 78 and 78B. Their top-notch performance, at low initial tool cost, will keep your machines operating profitably.

Chances are, your plant should be using *both* grades. Your local Authorized Distributor of Carboloy cemented carbides can deliver tools, blanks and inserts you need . . . in a hurry.

This complete team of Carboloy cemented carbides gives you more for your carbide tool dollar!



YOUR CARBIDE TOOL DOLLAR?

For nonferrous materials . . . boost production rates with Carboloy® cemented carbides performance-matched to your machining jobs

Aluminum, titanium, super alloys, wood—all have machining peculiarities that raise cain with production schedules and tool costs. That's why we make *five* job-tailored Carboloy cemented carbides for cutting these materials.

With these five grades (see chart, at left), you can get the one with exactly the right combination of shock resistance and wear resistance to match your job—whether heavy, interrupted cuts, or precision finishing.

Because you're using performance-matched carbides with consistent metallurgical quality, you can schedule heavier production loads . . . and you will get this increased output at lower tool-cost-per-piece.

Your local Authorized Carboloy Distributor has complete stocks of tools, blanks, and inserts in these five grades. A phone call to him today will get your machines humming faster tomorrow.

For more information on Carboloy Extra-Performance and General-Purpose carbides, or nonferrous material carbides, write: Metallurgical Products Department of General Electric Company, 11147 E. 8 Mile Street, Detroit 32, Michigan.

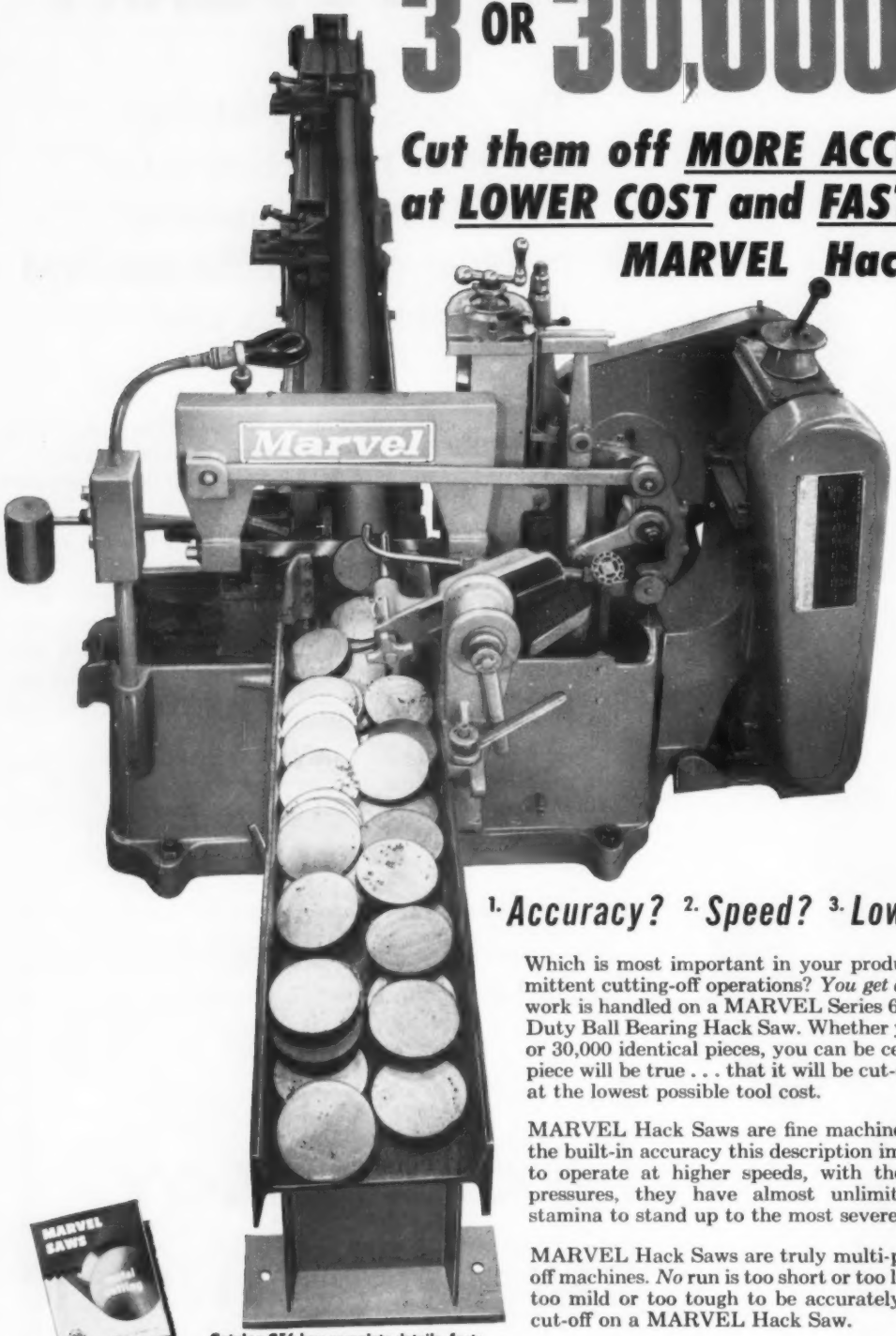
CARBOLOY®
CEMENTED CARBIDES

GENERAL ELECTRIC

For more data, circle page number of this ad on inquiry card

3 OR 30,000 PIECES

Cut them off MORE ACCURATELY at LOWER COST and FASTER on a MARVEL Hack Saw



1. Accuracy? 2. Speed? 3. Low Cost?

Which is most important in your production or intermittent cutting-off operations? *You get all 3* when your work is handled on a MARVEL Series 6A or 9A Heavy Duty Ball Bearing Hack Saw. Whether you're cutting 3 or 30,000 identical pieces, you can be certain that each piece will be true . . . that it will be cut-off quickly, and at the lowest possible tool cost.

MARVEL Hack Saws are fine machine tools, with all the built-in accuracy this description implies. Designed to operate at higher speeds, with the heaviest feed pressures, they have almost unlimited power and stamina to stand up to the most severe service.

MARVEL Hack Saws are truly multi-purpose cutting-off machines. *No* run is too short or too long, *no* material too mild or too tough to be accurately and efficiently cut-off on a MARVEL Hack Saw.

Catalog C56 has complete details, facts and figures on MARVEL Metal Cutting Saws. Write for it today.

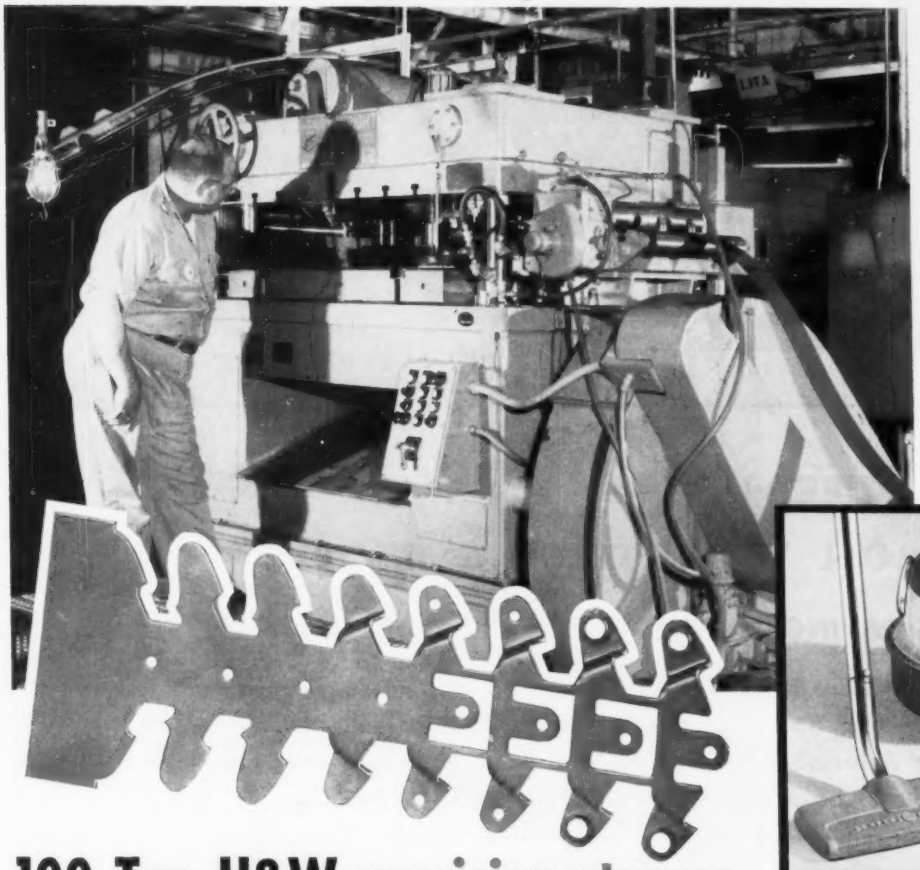
S-1306

ARMSTRONG-BLUM MFG. CO.
5700 BLOOMINGDALE AVE. • CHICAGO 39, ILLINOIS

MARVEL *Metal Cutting* SAWS
Better Machines–Better Blades

For more data, circle page number of this ad on inquiry card

Another H-P-M Henry & Wright . . . in service at General Electric



Another 100-ton Henry & Wright double crank dieing machine stamps floor tool brackets for model C-6 General Electric vacuum cleaner at Housewares and Radio Receiver Division, Cleveland, Ohio.

100-Ton H&W precision-stamps GENERAL ELECTRIC Vacuum Cleaner Part on 7 stage die

The precision, speed and flexibility with which the double crank H & W handles both the simple and complex progressive stamping jobs make it an integral part of the automation processes in many large companies such as General Electric. Its versatility greatly extends the range of work that can be handled.

The advantages of the double crank system include high speed operation with perfect alignment, even with severe off-center loads, and longer die life made possible by a pulling rather than a pushing stroke on the die. You can form larger parts on the lower capacity machines, or produce stampings requiring high pressures with precision. The machine has a low center of gravity, giving it greater rigidity and strength. Sizes from 25 to 500-tons meet your every need.

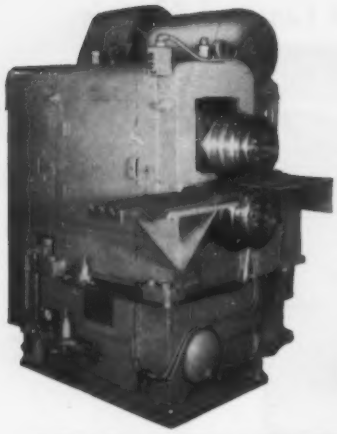
Assure yourself of top quality work and proven production economies with H & W dieing machines. Call or write your H-P-M representative today for complete information. You'll be glad you did!

H837

THE HYDRAULIC PRESS MFG. COMPANY

A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U. S. A.

For more data, circle page number of this ad on inquiry card



from the forging roll . . .

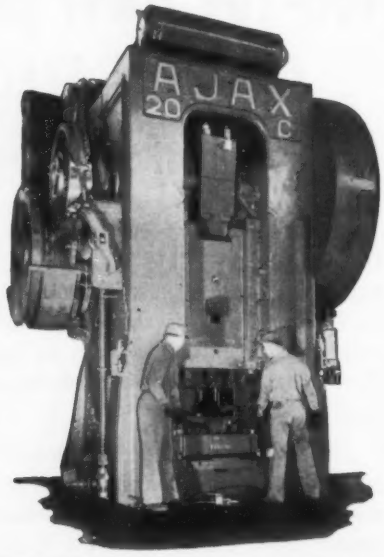
AJAX WIDE ADJUSTMENT FORGING ROLLS

PRE-ROLL YOUR FORGING BLANKS . . .

FOR METAL SAVING • LONGER DIE LIFE • BETTER FIBRE FLOW

AJAX ROLLS are built in seven sizes to pre-roll forging blanks ranging from Connecting Rod blanks to the largest Airplane Propellers. Illustrations show Automobile Connecting Rod blank formed (above) and press-forged (below) on **AJAX HIGH SPEED FORGING PRESS.**

. . . to the forging press



WRITE FOR BULLETIN 91-B

THE **Ajax** MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND 17, OHIO
110 S. DEARBORN ST., CHICAGO 3, ILLINOIS
W. P. WOOLDRIDGE CO. • BURLINGAME, CAL. • LOS ANGELES 22, CAL.

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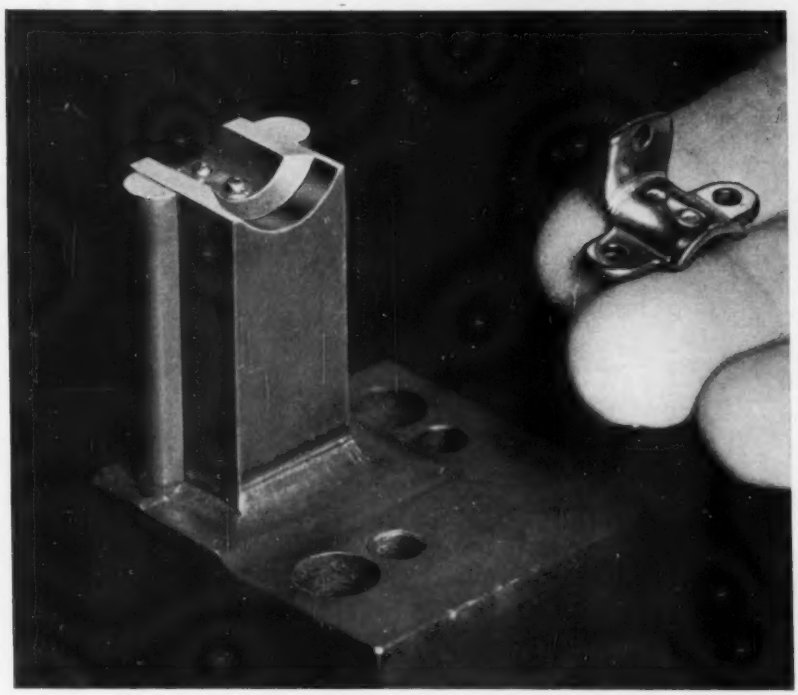
Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributors: Bethlehem Steel Export Corporation

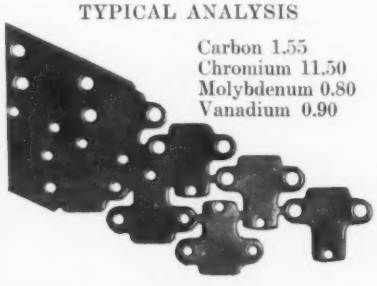


1½ million pieces with Lehigh H ...that's a long run in any league!

At Harvey Hubbell, Inc., Bridgeport, Conn., they were using a competitive grade of tool steel to form cord-clamp sections made from Grade 1010 steel strip. But each time they hit an average figure of 700,000 pieces, the die cracked, and had to be replaced. The manufacturer decided to call in Lindquist Steels Inc., a local distributor of Bethlehem tool steel.

TYPICAL ANALYSIS

Carbon 1.55
Chromium 11.50
Molybdenum 0.80
Vanadium 0.90



"With the finished part only .060 in. thick, we ought to do better than 700,000 pieces. What do you suggest?"

The distributor studied the operation, the cracked die, and the finished part. "I'd recommend Lehigh H," he said. "It has the strength you need in a forming operation of this sort." The Lehigh H was put on the job and produced 1½ million pieces without any trouble.

Lehigh H is our high-carbon, high-chromium, air-hardening tool steel. It's a grade with outstanding wear-resistance and toughness. And it's also a deep-hardening steel with high compressive strength.

The best way to evaluate Lehigh H is by putting it to work—not in an easy job, but in a tough one. Your Bethlehem tool steel distributor carries Lehigh H in stock, and will see that it's delivered promptly. Get in touch with him.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Don't Use Fresh Water For Quenching Tools

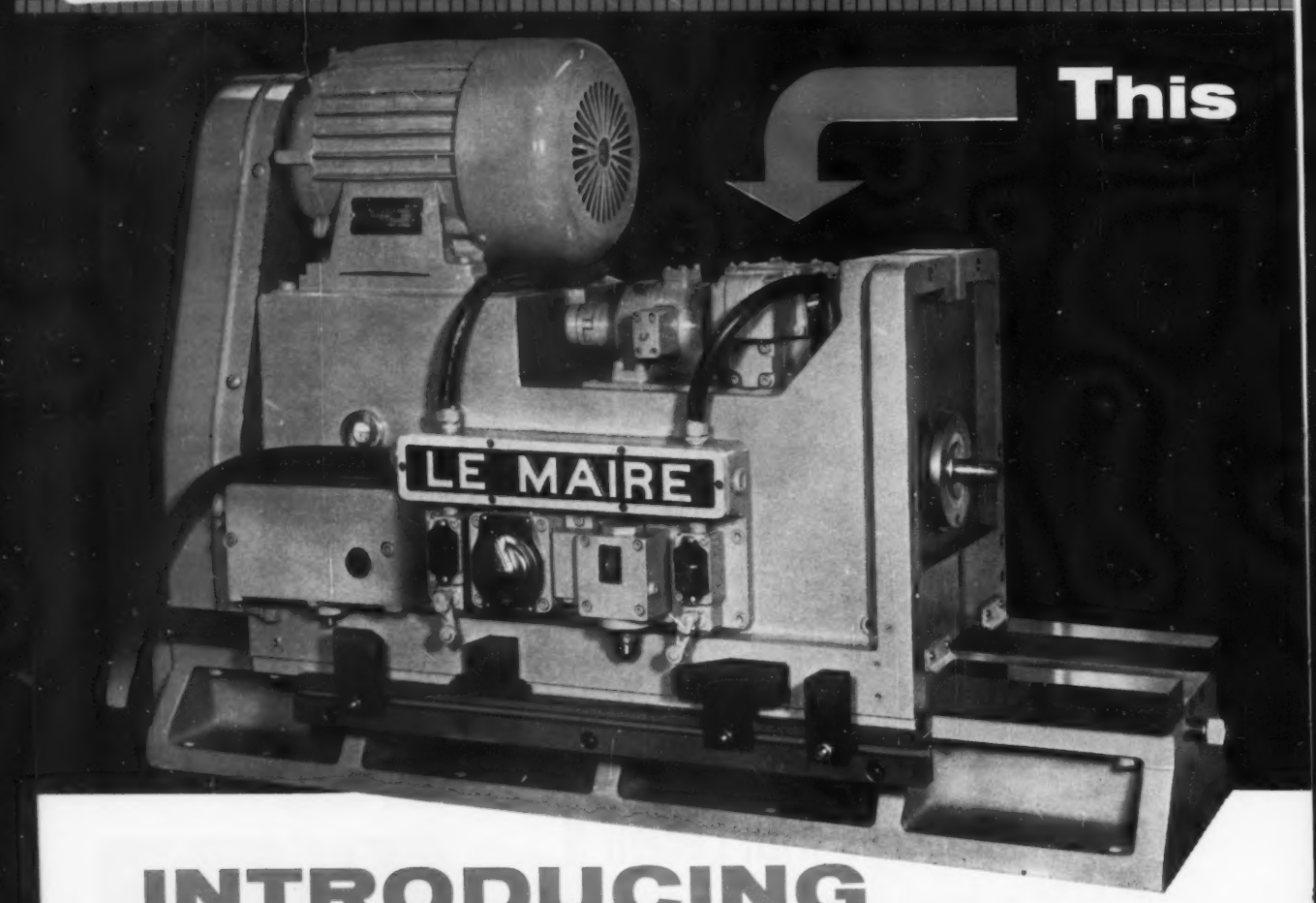
Fresh water, regardless of its source, contains dissolved gases which make it unsuitable for quenching tools. When tools are quenched in fresh water, gas is liberated at the surface of the tool. Gas pockets thus formed may prevent contact between tool and water, resulting in soft spots from ineffective quenching. Soft spots are undesirable because of their low hardness, and also because a quench which produces them may also cause cracking of the tools.

Soft spots, and tool cracking associated with soft spots, can be avoided by quenching in water which has been previously boiled, to remove the dissolved gases. If water cannot be boiled, quench a large amount of hot "dummy" material to expel the gases. As a further precaution against soft spots, it is preferable to use a 10 pct brine solution instead of water. It is also suggested that the dissolved gases be expelled from the brine solution before use.

USE DURAMOLD FOR COLD-HOBBING

Bethlehem's Duramold tool steels, in Grades A and B, are ideal for cold-hobbing plastic dies because they are free from injurious surface and internal defects. Duramold A, an air-hardening grade, is annealed to 109 max Brinell. Duramold B hardens in oil, and hobs more readily than Duramold A. It is annealed to 100 max Brinell, and has an addition of boron to increase the core strength.

PRODUCING



INTRODUCING
The LE MAIRE SU-5 Unit

Here's real "Building Block" construction for simple, economical automation! For here, on just one rotary indexing machine you'll find six *identical* LeMaire way-type hydraulic units performing nine *different* machining operations . . . with an arrangement which permits easy, rapid change-over to process three different sized parts as required.

The part is a diesel engine rocker shaft bracket. Setups for three different size parts are readily made with adjustable adaptors on the fixtures and adjustable spacers on the milling arbors. Production is 112 pieces per hour at 100% efficiency. Here's what happens at each station.

(1) Load **(2)** Drill large hole **(3)** Spot face and chamfer large hole **(4)** Ream large hole **(5)** Straddle mill top of boss and mounting face **(6)** Drill small cross hole to half depth **(7)** Drill small cross hole to full depth **(8)** Finish mill mounting face **(9)** Finish bore large hole to .0005" tolerance.

The LeMaire SU-5 way-type units used on this machine are extremely suitable as "building blocks" which can be used over and over in widely varied applications. They are entirely self-contained, with cross-keyed construction which permits ready removal and re-mounting. Features of the units include variable delivery pump, hardened and ground ways, automatic lubrication and spindle speed changes. For ease of maintenance and replacement, all component elements are manifolded to provide ready accessibility.

The machine itself features precision balanced spindles for milling and boring, a variable speed pump to power the hydraulic indexing mechanism, automatic lubrication, and J.I.C. electrical and hydraulic systems. Perhaps a similar arrangement of versatile LeMaire way-type units can simplify your production machining problem. Call or write for consultation with a LeMaire field engineer.

with LE MAIRE

Versatile New LE MAIRE Unit Powers Every Operation On This LE MAIRE Machine

LE MAIRE MACHINE TOOL COMPANY

2657 S. TELEGRAPH ROAD
DEARBORN, MICHIGAN

Designers and Builders of
Special High-Production Machines

this 140-TON horizontal milling machine

There's never been one like it before!

Just a press of a button puts this mighty Schiess into action. A 25-ft. high column moves smoothly along 45-ft. long bedways. Never a vibration—no chatter—even at maximum transversal loads! The new Schiess design of the spindle heads has eliminated this!

THE MILLING OPERATION. A huge tungsten-carbide cutter in a 14¼" spindle goes to work on the stock. And performs its operation with a consistent accuracy—a surface-finish count—never before obtainable on such a big fellow.

THE BORING OPERATION. Another press of a button! Another spindle goes to work—bores a 79" depth in one cut—or a total depth of 118". Boring and milling spindles are provided with 36 speeds of which the top 12 are V-belt transmitted. Rapid traverse, feeds and manual controls of the two spindles are completely independent.

That this mighty machine has tremendous productive capacity is self-evident. And its productivity goes far beyond conventional milling and boring. Schiess attachments increase its scope to taper-milling, thread-cutting, copying and, in certain instances, copying in 3 dimensions. It's a time saver, too. Can go from feed to rapid traverse immediately, without complicated adjustments.

The Schiess Model FB 36/22.5 Horizontal Milling and Boring Machine is a product of Europe's largest builder of heavy machine tools. Parts and service are as close as Pittsburgh. An American Schiess Engineer will be happy to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on all five FB models.

also bores and turns

Face milling entire side of 38' x 14' press frame on Schiess Model FB 36/22.5

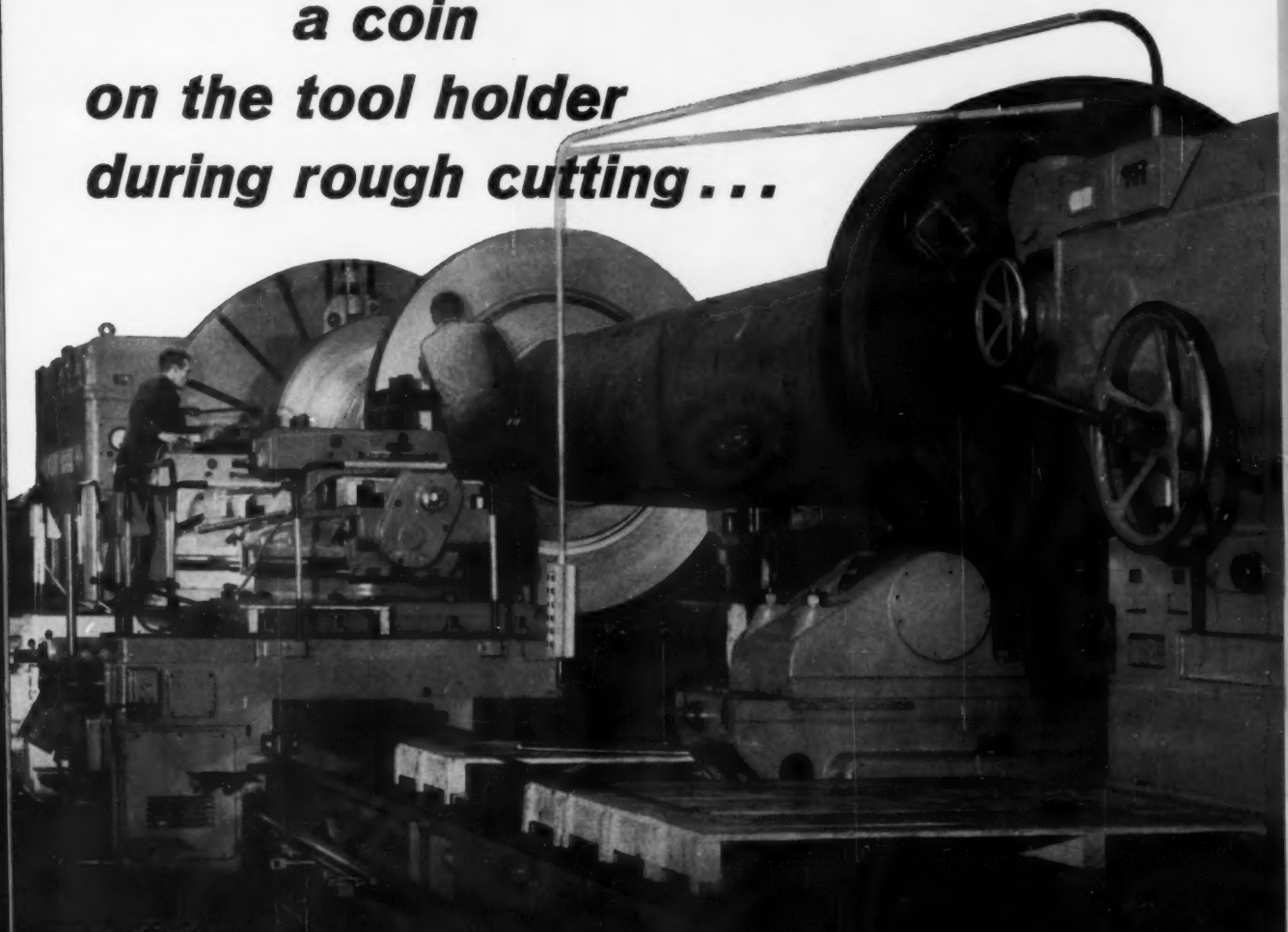
SCHIESS

AMERICAN SCHIESS CORPORATION

1232 Penn Avenue, Pittsburgh 22, Pa.

For more data, circle page number of this ad on inquiry card

you can balance a coin on the tool holder during rough cutting...



on this

waldrich high speed lathe

Series WSD

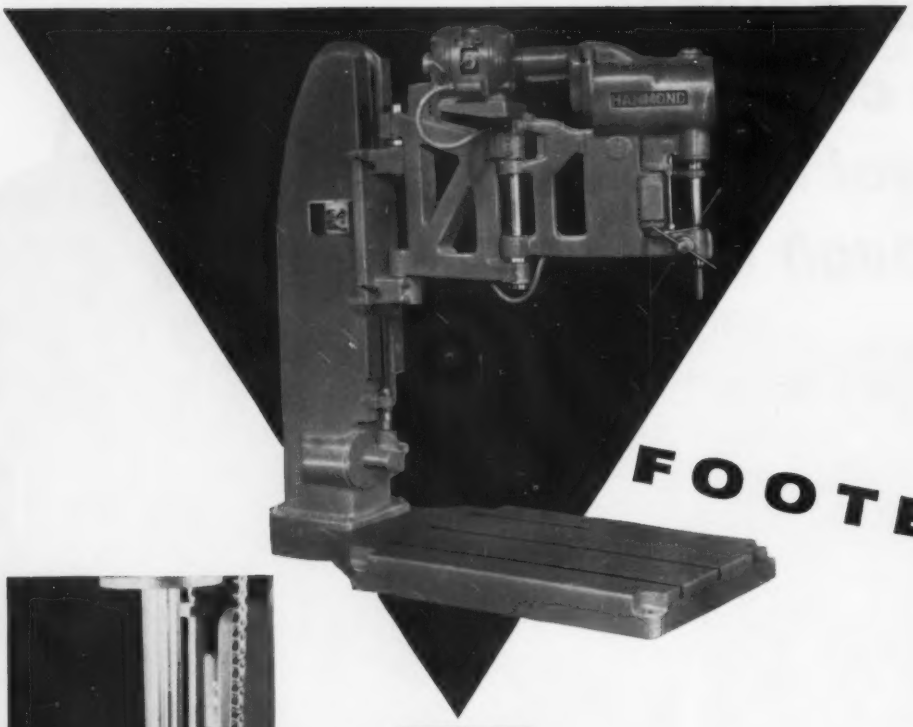
- Rigid construction insures vibration-free operation with carbide tools.
- Maximum utilization of horsepower in main drive
- Rugged headstock
- Heavy duty tail stock
- 3-way and 4-way bed design
- Fast, efficient chip collecting

Write for details today.

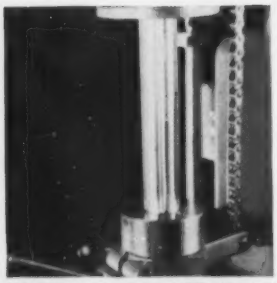
WALDRICH SIEGEN

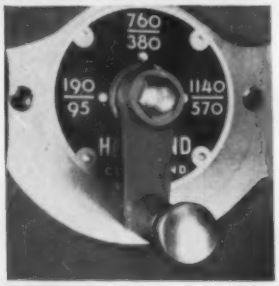
american waldrich mfg. corp.

1232 PENN AVENUE, PITTSBURGH 22, PENNSYLVANIA



FOOTBURT





for Faster radial drilling and tapping

Hammond Radial Drilling and Tapping Machines may be spotted in the production line for drilling, tapping or reaming. With its unique Bracket Type construction the spindle can be swung quickly from hole to hole. Six Quick Speed Changes are instantly available and the Hammond Tapping Reverse is very fast and convenient to operate.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

Detroit Office: 24632 Northwestern Highway, Detroit 35, Mich.

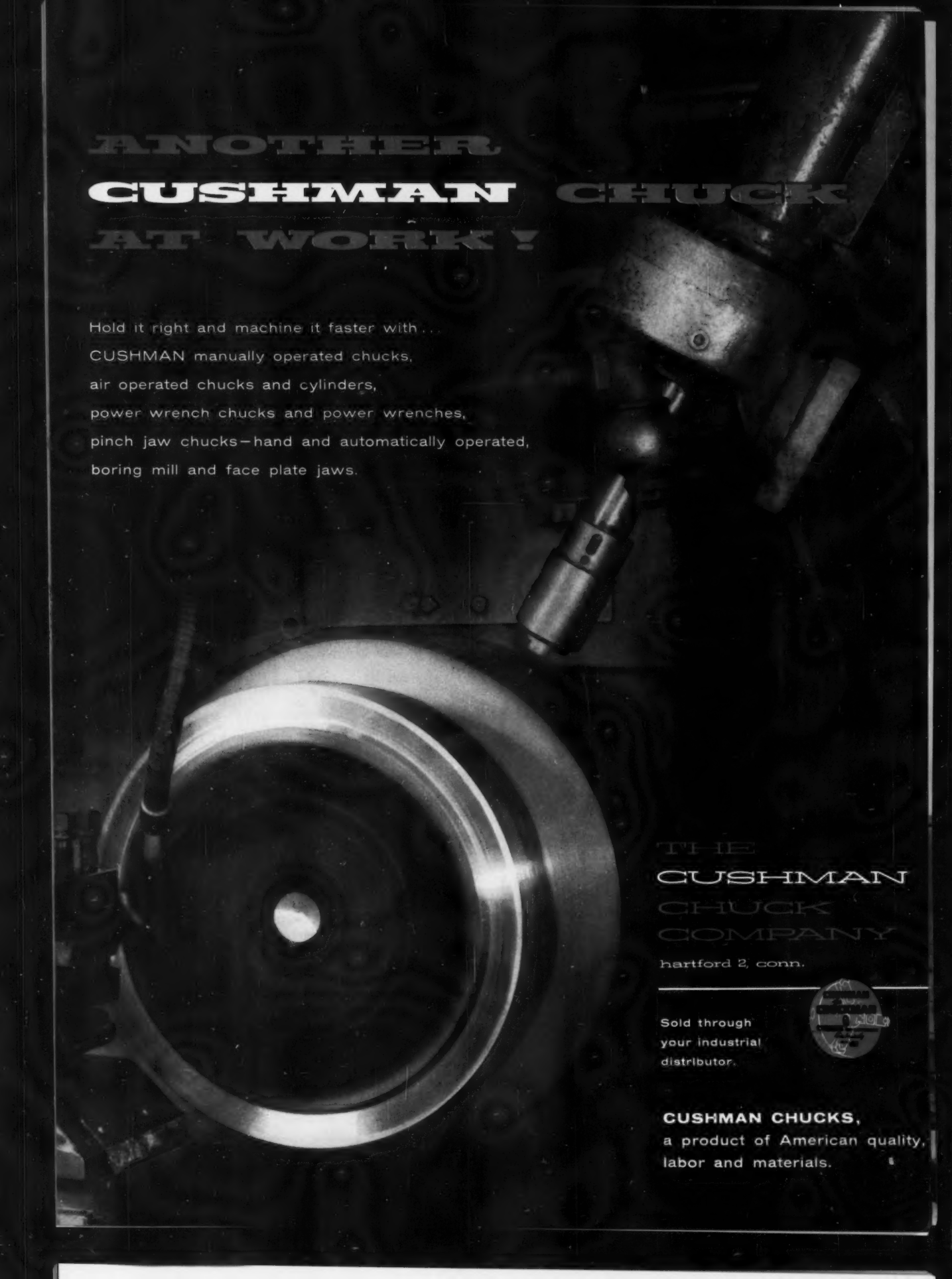
Write for Circular #7A.

ENGINEERED FOR PRODUCTION

FOOTBURT

MACHINE TOOLS

For more data, circle page number of this ad on inquiry card


ANOTHER
CUSHMAN CHUCK
AT WORK!
Hold it right and machine it faster with . . .
CUSHMAN manually operated chucks,
air operated chucks and cylinders,
power wrench chucks and power wrenches,
pinch jaw chucks—hand and automatically operated,
boring mill and face plate jaws.
THE
CUSHMAN
CHUCK
COMPANY
hartford 2, conn.
Sold through
your industrial
distributor.
CUSHMAN CHUCKS,
a product of American quality,
labor and materials.

New SHEFFIELD "Centerfind"

Assures PRECISE ALIGNMENT for Jig Grinding or Boring

"Centerfind" enables an operator to align a work part hole precisely with the jig bore or jig grinder spindle axis.

A pressure-sensitive pick-up stylus is rotated by the spindle to tram the inner surface of the work part hole. As the stylus moves through its orbit, any change in pressure on it indicates misalignment and this is registered on the column Precisionaire. When the hole center is brought into precise alignment, the Precisionaire float remains stationary.

Checking is done while the spindle rotates, thus eliminating torque error which is a serious obstacle when alignment is attempted from a stationary spindle.

Because spindle-to-stylus distance approximates boring tool length, variations caused by vertical quill movement are minimized.

In addition to the reasons above, the high degree of accuracy obtainable with "Centerfind" is due to having only one moving part and the high amplification of the Precisionaire gage.

Other uses for this instrument are the checking of spindle runout and the squareness of a hole with its adjacent face.

"Centerfind" for checking holes up to 5" dia. is recommended to be used with Precisionaire Gages of 2000 or 5000 to 1 amplification. Higher amplifications and larger hole diameter capacity, when required.

For further information, write to The Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 9.

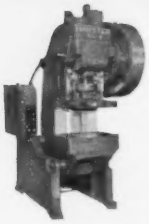
the SHEFFIELD corporation
of Bendix Aviation
[manufacture and measurement for mankind

8027

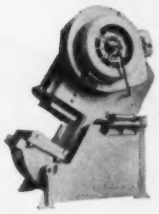
For more data, circle page number of this ad on inquiry card

TYPES AND CAPACITIES— MINSTER® PRESSES—A COMPLETE LINE

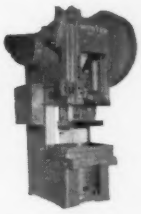
SINGLE POINT, GAP TYPE, OPEN BACK



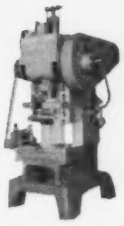
Series 1
Inclinable
6 Capacities
12 THRU 60 TONS
Bulletin Section 1



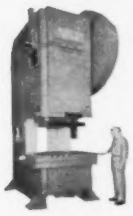
Series 1
Inclinable
Two Capacities
75 THRU 90 TONS
Bulletin Section 2



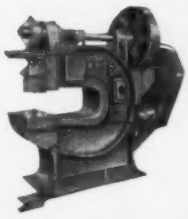
Series 70
Fixed Base
Four Capacities
45 THRU 90 TONS
Bulletin Section 3



Series B1
Fixed Base, Automatic
Five Capacities
16 THRU 60 TONS
Gap Press Bulletin

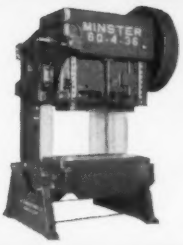


Series G1
Fixed Base or Inclinable
Four Capacities
75 THRU 250 TONS
Bulletin Series G1

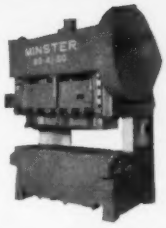


Series 20
Deep Throthroat Type
Three Capacities
15 THRU 35 TONS
Gap Press Bulletin

TWO POINT, GAP TYPE, OPEN BACK

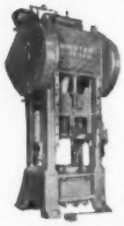


Series 60
Inclinable—Five Capacities
22 THRU 75 TONS
6 Widths Ea. Cap.
Request Specifications

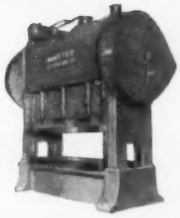


Series 80
Fixed Base—
Five Capacities
22 THRU 75 TONS
6 Widths Ea. Cap.
Request Specifications

STRAIGHT SIDE PRESSES



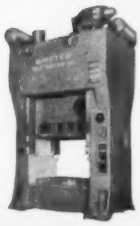
Series S1
Twelve Capacities
50 THRU 600 TONS
Bulletin Series S1



Series S2
Ten Capacities
50 THRU 400 TONS
Five Widths Ea. Cap.
Bulletin Series S2

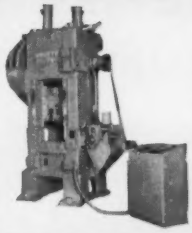
STRAIGHT SIDE PRESSES — M SERIES

Series MS1
Three Capacities
300 THRU 500 TONS
Request Specifications

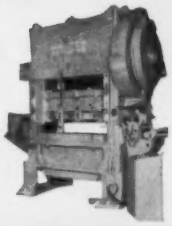


Series MS2
Five Capacities
150 THRU 500 TONS
Five Widths Ea. Cap.
Bulletin Series MS2

PIECE-MAKER AUTOMATIC PRODUCTION PRESSES

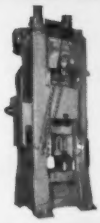


Series P1
Three Capacities
75 THRU 150 TONS
Bulletin Series P1



Series P2
Nine Capacities
20 THRU 300 TONS
Four Widths Ea. Cap.
Bulletin Series P2

KNUCKLE JOINT PRESSES



Series 90
Six Capacities
150 THRU 1000 TONS
Bulletin Series 90

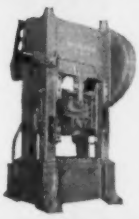
PROGRESS-O-MATICS

Series PMS2
Five Capacities
150 THRU 500 TONS
Five Widths Ea. Cap.
Request Specifications

HORNING PRESSES

Series 10
Eight Capacities
16 THRU 90 TONS
Bulletin Series 10

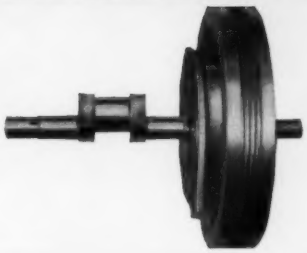
HEAVY DUTY BLANKER



40E-9
400 TON
Bulletin 40E-9

CLUTCH CONVERSIONS

Minster patented Combination Air Friction Clutch and Brake unit for clutch conversions increases production, reduces maintenance.
Bulletin CC57



MINSTER®

THE MINSTER MACHINE COMPANY

MINSTER, OHIO

FIRST IN PRESS DESIGN

MINSTER MACHINE COMPANY
MINSTER, OHIO

Gentlemen: Please send me a copy of Bulletin_____

Name_____ Title_____

Company_____

Address_____

City_____

Nature of Product_____

JONES & LAMSON "AUTOMATION"

the man who needs a new machine tool is already paying for it

Numerical control positioning eliminates jigs – saves time

The J&L Numerically Controlled Positioning Table quickly and accurately positions work pieces to an accuracy of ±.001″ — without jigs. And it can do it economically with any lot size down to a single piece.

For instance: in one installation, where precision parts previously had been machined on a conventional spacing table, J&L's new equipment achieved cycle time savings of six minutes per piece and set-up savings of over 116 minutes per set-up, or a total savings of 6.95 hours on a lot of 50 pieces.

In another plant, the cost of building $4,000 worth of jigs was eliminated during the first six weeks of operation. And in still another operation, the positioning table not only reduced set-up and cycle time, but also eliminated the storing, handling and maintenance of $29,000 worth of jigs.

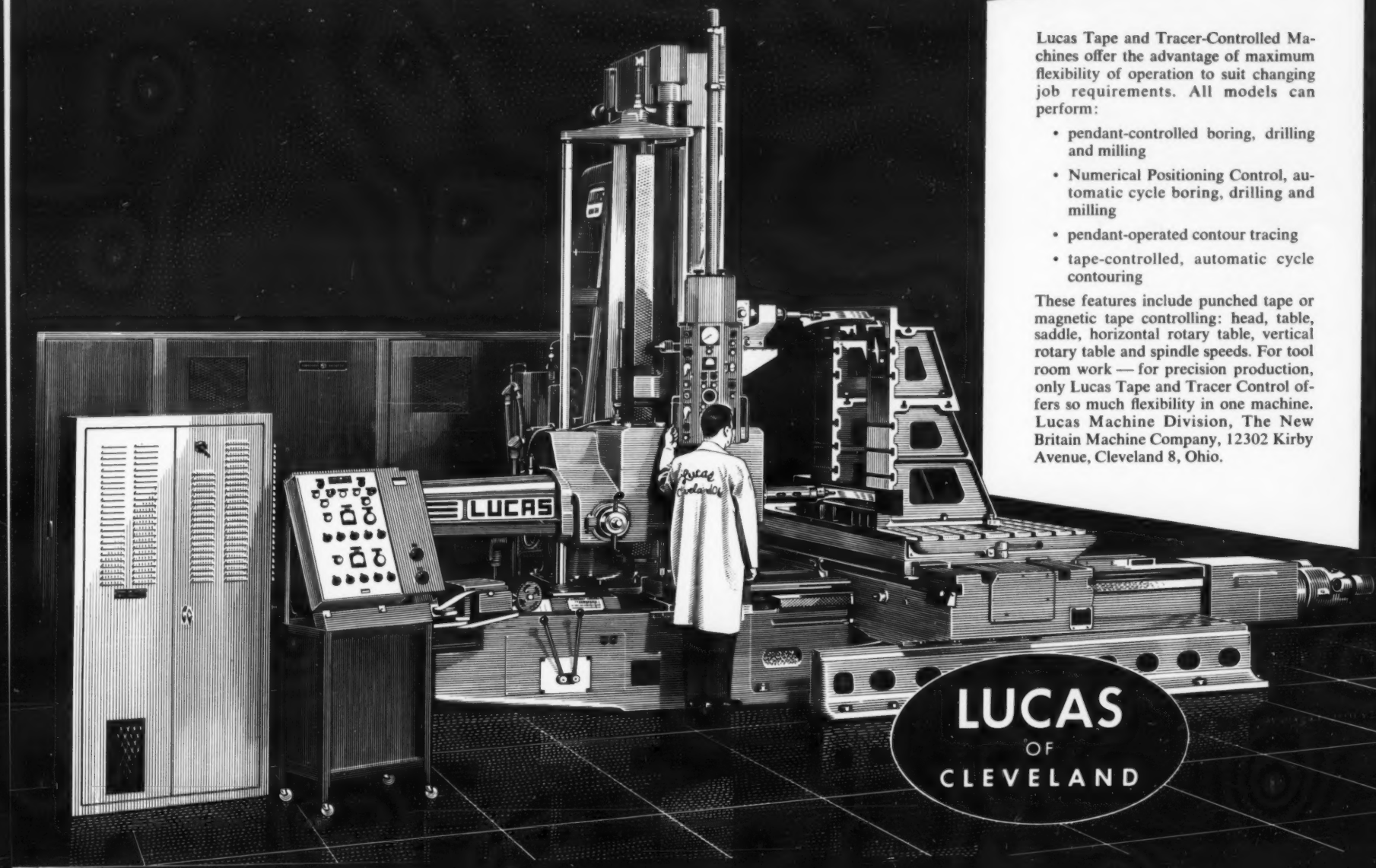
You can get in on this kind of savings too. Write to Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

For more data, circle page number of this ad on inquiry card

A New Lucas Lathe
Fully-automatic Tape Control, Tracer Control or both. Infinitely variable speeds and feeds. Automatically-maintained, constant-cutting speeds on changing diameters. Console control from moving operator's platform. *Three* hardened and ground ways. Self-contained Motor Generator Set.
The Lucas Lathe — perfect for your large, lightweight, close tolerance, intricately-shaped problem jobs. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.
LUCAS
OF
CLEVELAND

Lucas Tape and Tracer Control



Lucas Tape and Tracer-Controlled Machines offer the advantage of maximum flexibility of operation to suit changing job requirements. All models can perform:

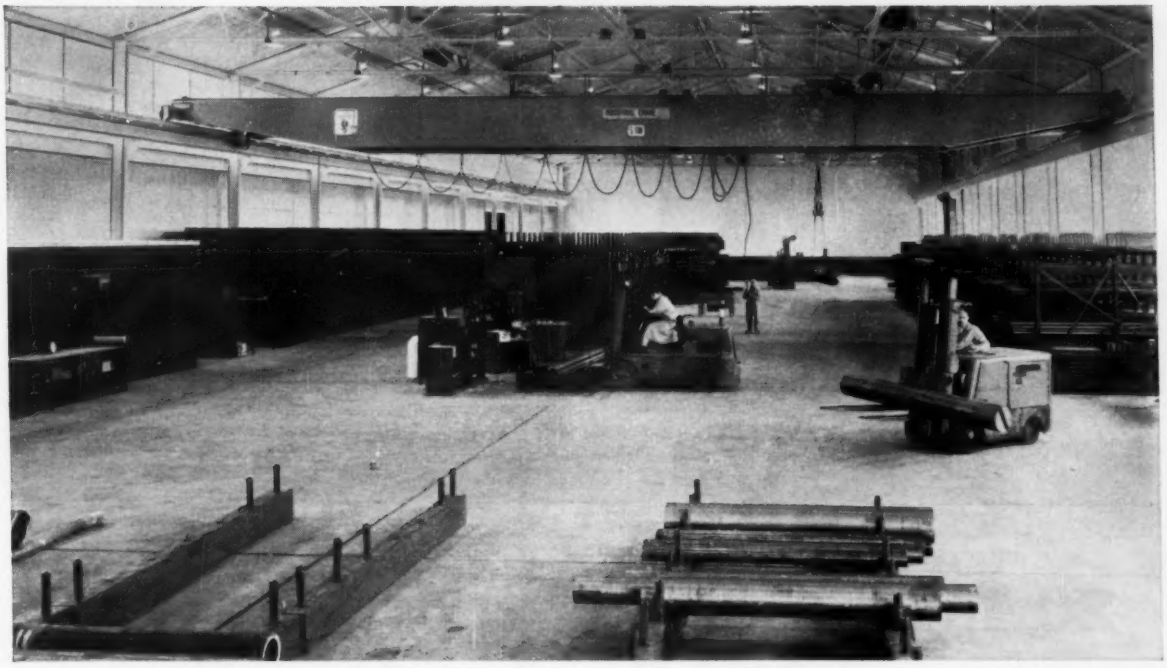
- pendant-controlled boring, drilling and milling
- Numerical Positioning Control, automatic cycle boring, drilling and milling
- pendant-operated contour tracing
- tape-controlled, automatic cycle contouring

These features include punched tape or magnetic tape controlling: head, table, saddle, horizontal rotary table, vertical rotary table and spindle speeds. For tool room work — for precision production, only Lucas Tape and Tracer Control offers so much flexibility in one machine. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.

LUCAS
OF
CLEVELAND

NOW IN OPERATION !

New warehouse to make your Timken® graphitic tool steel and 52100 tubing shipments faster than ever



NOW you can get shipments with more speed than ever before because our new warehouse for Timken® graphitic tool steels and 52100 tubing has speed built in. Here's how the new warehouse helps you:

WITHIN 24 HOURS of the time we get your order, we can have the material on its way to you with the help of ultra-modern handling equipment and methods.

FEWER DELAYS EN ROUTE. We built our new warehouse on main railroad and truck routes in Canton, Ohio, for faster shipping.

ALWAYS A FULL STOCK. Moving steel to the warehouse now takes only minutes because mill and warehouse are side-by-side. This makes it easier to maintain full warehouse stocks.

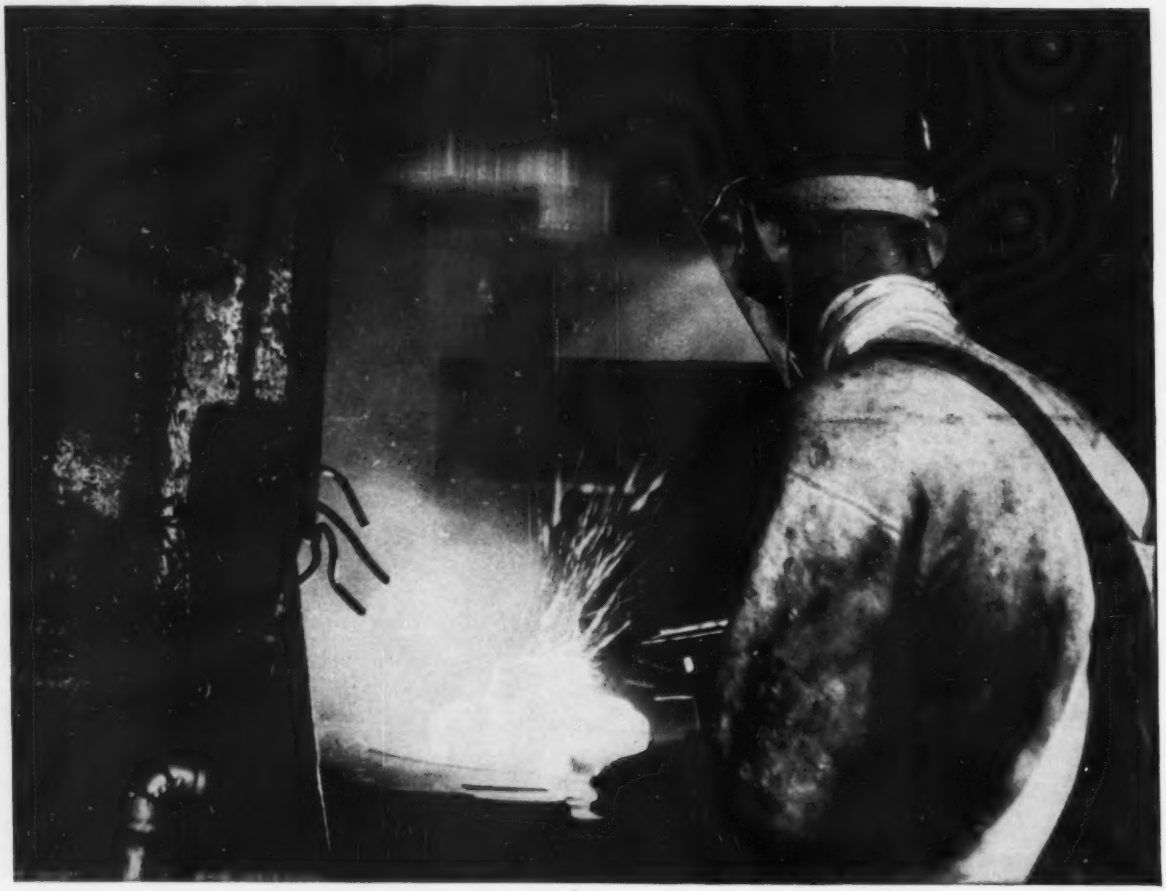
WIDE SELECTION OF STEELS. From the new warehouse, you can choose from over a hundred sizes of *52100* tubing and fifty sizes of 4620 tubing. Graph-Mo®, Graph-Air®, Graph-Tung®, and Graph-Al are available in more than one thousand sizes. You can get Graph-Mo in hot rolled bars, rounds, squares, precision ground flats, billets or hollow-bar.

Now, more than ever, when you want these steels fast, phone or write your order to The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO". Tapered Roller Bearings, Alloy Steels and Seamless Steel Tubing, Removable Rock Bits.

TIMKEN *Fine Alloy* STEEL

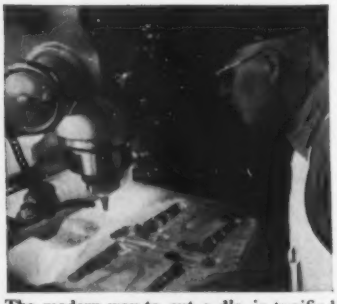
TRADE-MARK REG. U. S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING



Interstate Drop Forge Company—

20 Years a Cities Service Customer and Still Forging Ahead!



The modern way to cut a die is typified by die sinking machine, one of many at Interstate Drop Forge Company. All die sinking machines are lubricated by Cities Service lubricants.

With production running at roughly 1000 tons per month, Interstate Drop Forge Company of Milwaukee is one of the largest forging concerns in the Wisconsin area and growing all the time.

An integral part of this growth story, Cities Service is proud to have filled Interstate's lubrication needs for the past 20 years.

Drop hammers... helve hammers... upsetters . . . forging rolls . . . shapers . . . automatic metal saws. These are but a few of the diversified machines lubricated by specially tailored Cities Service oils and greases.

Actually, in a plant of this type with so many differing pieces of machinery, it would be possible to have as many as 25 different lubricants. But, Interstate, with the aid of their Cities Service Lubrication Engineer has been able to standardize on twelve Cities Service lubricants.

Streamlining . . . standardizing . . . improving. These are some of the services a Cities Service Lubrication Engineer can render for your operation, too. Ask him to make a free lubrication survey of your plant. Call the nearest Cities Service office or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

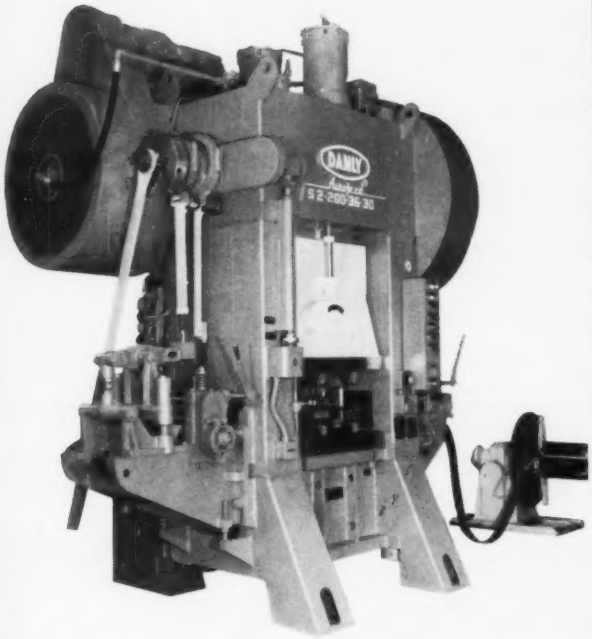
QUALITY PETROLEUM PRODUCTS

For more data, circle page number of this ad on inquiry card

DANLY®

The Leading Supplier to the Stamping Industry

in PRESSES

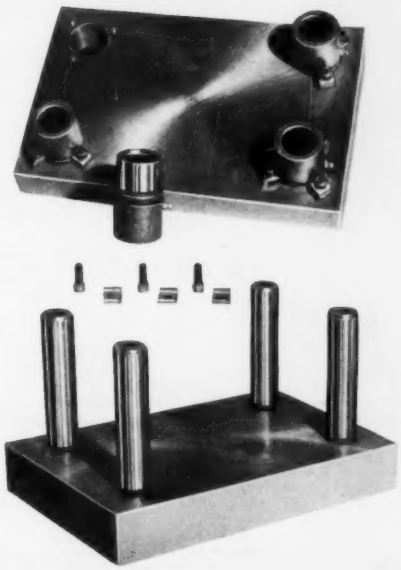


The report of the Business and Defense Service Administration shows that Danly led all producers of presses during 1957. Industry made Danly the first choice because you get lower operating costs with a Danly Press—you can depend on it! Each press is engineered to turn out more accurate stampings . . . to produce more units per shift . . . and to reduce profit-eating maintenance and spare parts inventories.

There are many new developments you should know about, such as the Quick Die Change feature available on all Straight Side Presses . . . single, double and triple action . . . the modern high-production Autofeeds . . . and the completely modern line of Open Back Inclinable presses just introduced. See how Danly can help you reduce costs and give your products the stamp of leadership!

Write for the new Autofeed Catalog that gives full information on Danly Presses for high-production stampings.

in DIE SETS and Die Makers' Supplies



With the introduction of the Demountable Bushing Die Set, Danly is now working on its fifth million in die set production. Included in this production are die sets mounted in five Danly Autofeed Presses that produced a million pieces per grind with an average of 219,000 pieces per .001 inch of die grind.

In every instance, Danly can meet your most exacting diemaking specifications with a die set—standard or special. Since pioneering the first mass-produced precision die sets 36 years ago, Danly has continuously developed new production, inspection and distribution methods to serve you better.

Today, there's the new Danly Die Set with Demountable Bushings being assembled in a factory branch or distributor assembly plant near you. It is your fast, convenient source for toolroom and pressroom supplies that bear the stamp of leadership. Danly facilities for special Die Set manufacture are also improved and expanded .

Send for money-saving facts. Write us and your distributor or branch will give you helpful information on Danly Die Sets.

DANLY MACHINE SPECIALTIES, INC.

DANLY®

2100 S. Laramie Avenue, Chicago 50, Illinois

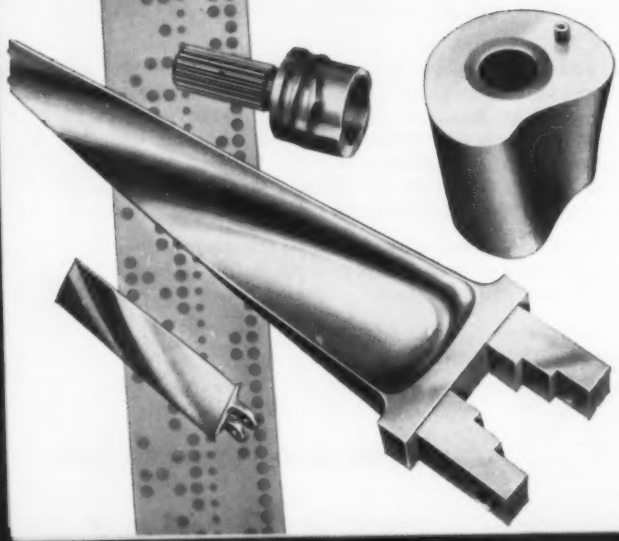
Now—a machine which can realize the full potential of tape control!

FIRST

FIRST to provide 360° work rotation for 3-dimensional machining of complex parts

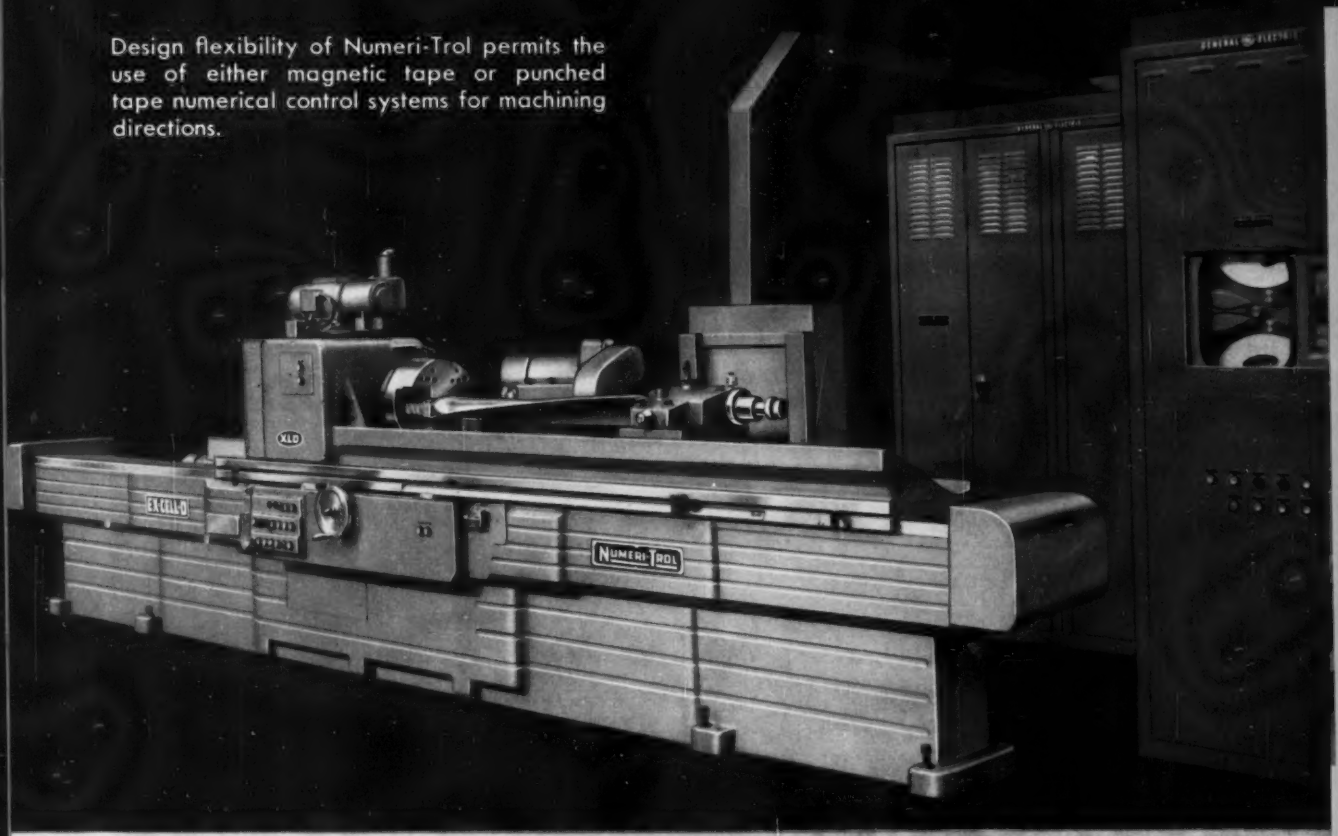
FIRST to combine grinding, dressing, and dressing compensation with milling

NUMERI-TROL



Numeri-Trol slashes lead time, tooling cost and machining time of intricate, three-dimensional prototypes and precision parts. Rotary feed of the work, plus lateral motion of the work head and transverse motion of the cross slide permit milling and finish grinding of parts too complex to be economically produced by conventional methods. Grinding wheel dressing and dressing compensation are fully tape-controlled. In addition to grinding, three-dimensional machining with Numeri-Trol includes conventional rotary milling and longitudinal milling with automatic work feed and 360° indexing.

Design flexibility of Numeri-Trol permits the use of either magnetic tape or punched tape numerical control systems for machining directions.



TAPE CONTROLLED PRECISION PROFILING MACHINES BY EX-CELL-O

Precision-made to heavy-duty production standards, Numeri-Trol sharply reduces machining time and eliminates human error in the production of irregularly-shaped parts. Created especially to take advantage of the accuracy and design possibilities made available by high-performance numerical control systems, Numeri-Trol does away with the need for cams, templates and models; on many once-difficult jobs, it practically eliminates tooling and costly fixtures. Write direct, or ask your Ex-Cell-O Representative how easy it is to "tape" your toughest part and produce it on Numeri-Trol.

XLO EX-CELL-O FOR PRECISION

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

For more data, circle page number of this ad on inquiry card

58-50

ALLEN HEX-SOCKET SCREWS HEAD

HERE'S ALLEN TODAY!

These precision products have made ALLEN the number 1 name in the socket screw field!

If hex-socket screws have any place in your life at all, our new plant at Bloomfield, Connecticut, has unlimited advantages for you.—If you're an engineer or designer, for example, the modern facilities of this new plant make available to you greatly increased engineering and metallurgical services in the development of dependable fastening for products you're designing—and higher standards of precision than ever before. If you're a manufacturer, this new plant is bound to be a rich source for new ideas in fastening, and new products that will make your own products better. If you are a distributor, this new plant means prompter shipments—and both new products for your customers and improvements in existing ones, all coming along rapidly now that we have the room we need and new equipment.

Write today for our new picture-booklet that takes you on a "guided tour" of this modern new plant.

ALLEN MANUFACTURING COMPANY

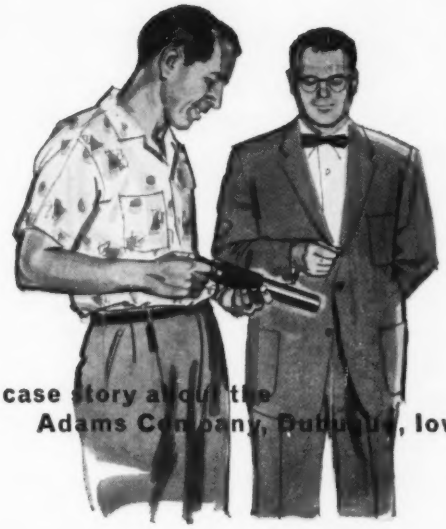
Hartford 1, Connecticut

Plant at Bloomfield, Connecticut • Warehouses at Chicago and Los Angeles

For more data, circle page number of this ad on inquiry card

Bob showed them a new product that ended rust on work and tools—

STANDARD Special Transparent Coolant



A case story about the Adams Company, Dubuque, Iowa

Before Standard Oil lubrication specialist Bob Wenger told The Adams Company management about Standard's SPECIAL TRANSPARENT COOLANT, there had been considerable trouble with rusting of work and machines in the plant. There had also been trouble with deposits on the ways of the grinding machines. Rust occurring on parts being processed was resulting in damage and even losses. This has been changed.

"Since we changed to your SPECIAL TRANSPARENT COOLANT, we have not had any rusting or deposits on our machine tools, and this product has eliminated the rusting problem on parts being processed through our plant," says Harlow Adams, president of the company.

The Adams Company found they received important additional benefits as well. Operators could now see their work clearly. There was less wheel loading. Because the coolant didn't foam, more of it stayed on the wheel resulting in cooler operation. Faster cuts were obtained with finer wheels. Finer wheels gave better finishes. Periods between dressings were extended. Tolerances were maintained.

Research, development and more than two years of field testing have gone into Standard's SPECIAL TRANSPARENT COOLANT. This is the pay-out to you on the research done by Standard Oil to bring you better metalworking products. Find out more about Standard's SPECIAL TRANSPARENT COOLANT. Call your nearby Standard Oil lubrication specialist in any of the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

Quick facts about

Special Transparent Coolant

- Clear, transparent fluid.
- Able to control corrosion and rust on work and machines.
- All chemical. Does not support bacteria growth.
- Unaffected by humidity.
- Nonfoaming.
- Fire resistant.
- Odorless.

No rust. Shaft ground with Standard's SPECIAL TRANSPARENT COOLANT shows no rust on inspection by A.T. Murphy, General Superintendent, Harlow Adams, President, and Bob Wenger, Standard Oil lubrication specialist.

You expect more from STANDARD *and get it!*

be a Profit prophet ...without Crystal Ball!

Users of U. S. Adjustable Drill Heads are unusually accurate in anticipating profit pictures— they regularly figure lower and *more dependable costs.* That's because these high-quality heads—priced right to start with—usually cost less to maintain, less to operate.

The U-1 Head shown has 8 drivers, 1/4" drilling capacity in cast iron, 6" diameter drilling area. With 2 spindles and Erickson chucks, it costs only $260.

And that's because ALL U. S. Heads of this type have these plus features:

SHAVED GEARS for smooth, quiet operation.
SPECIAL UNIVERSALS with heat treated joints, neoprene sealed and lubricated for life.
ALUMINUM BODY CASTING with special 33,000 lb. tensile.
GREATER BEARING AREA for the spindles.
QUICK CHANGEOVER for different hole patterns.
SLIP SPINDLE PLATE, providing the advantage of a fixed center head on long runs.

Write for catalog AD-57. Immediate delivery on most standard sizes.

Adjustable and Fixed Center Multiple Drilling Heads
Individual Lead Screw Multiple Tapping Heads

US DRILL HEAD

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO

For more data, circle page number of this ad on inquiry card

T-J CUTTERS

assure higher production precision die sinking!

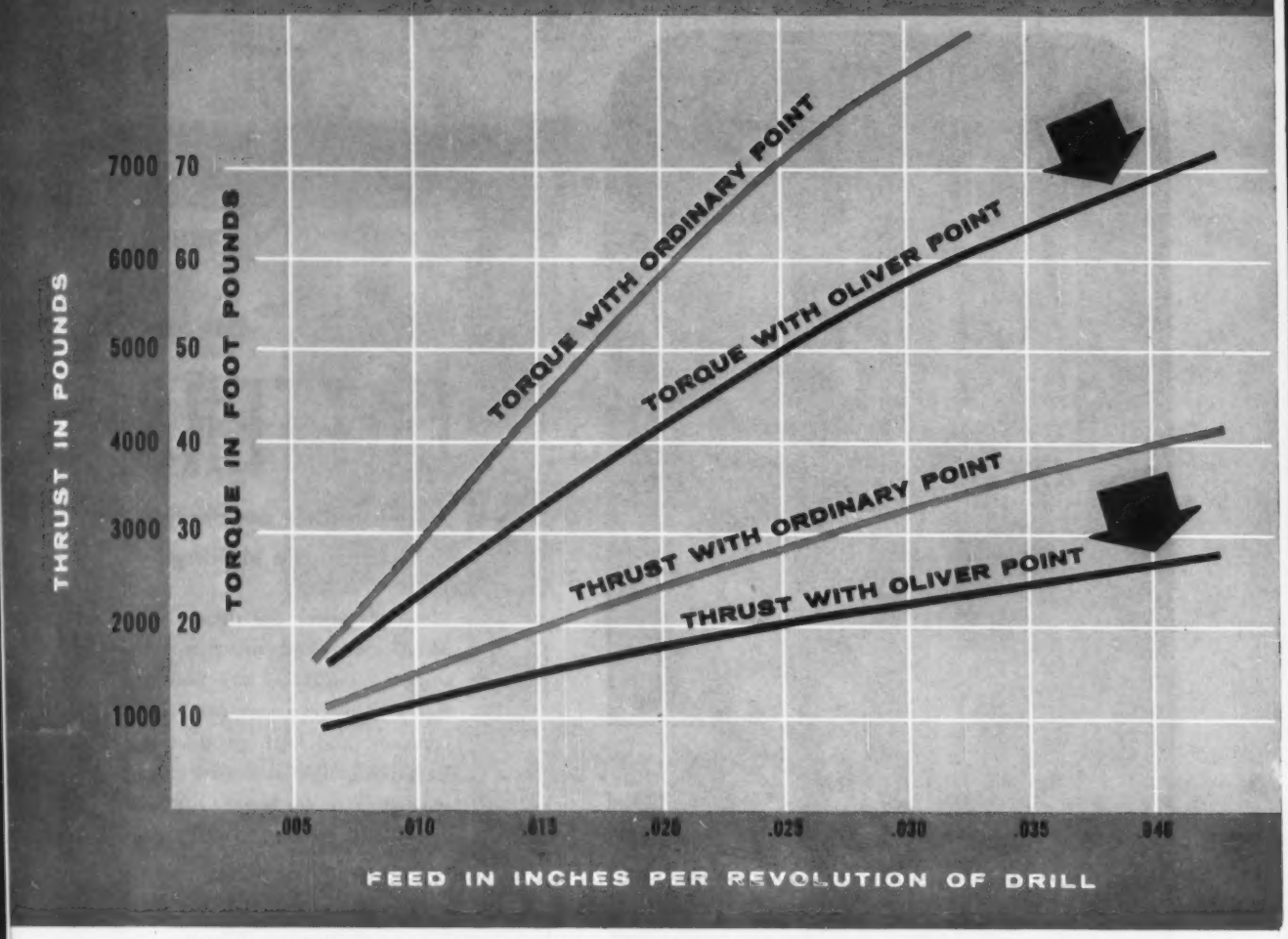
The facts speak for themselves when more and more metal-working engineers are finding that T-J Cutters assure precision accuracy, and high production die sinking. T-J Cutters are extra sturdy too . . . for longer life . . . reduced die costs . . . more profits for you.

Specially designed and precision manufactured for speed, accuracy and long life, T-J's complete cutter line means less breakage . . . more work between grinds. Made from the finest tool steels available . . . properly machined . . . scientifically heat-treated and accurately ground. Send for catalog No. 1057 for information of T-J's wide range of styles and sizes. The Tomkins-Johnson Co., Jackson, Mich.

We Invite Your Inquiries on Special Cutters Too!

T-J TOMKINS-JOHNSON

RIVETORS, AIR AND HYDRAULIC CYLINDERS, CUTTERS, CLINCHORS

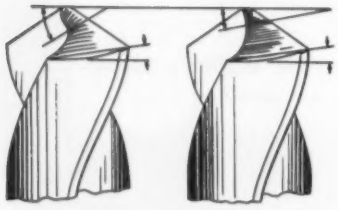


CURVES SHOWING EFFECT OF VARYING FEEDS, TORQUE and THRUST—1″ DRILL IN C. R. S.

OLIVER DRILL POINTER

PROOF!

OLIVER helps you get *more holes per grind!*

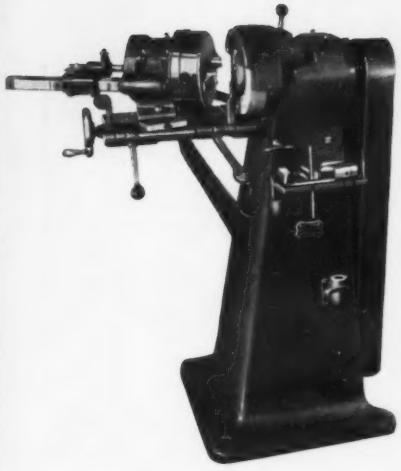


The drill point on the right is one as ordinarily ground. On the left is an exaggerated view of an Oliver drill point. Note that the clearance angle on the point increases very rapidly as the drill web is approached.

Substantially less torque—much less thrust!

The above graph is the result of tests run by the research department of an eastern engineering school. It is evidence that Oliver can help you get more and better holes per grind.

Oliver's sharpening principle is to grind the drill point so that increased clearance is obtained at the center of the drill. The cut is balanced with each lip doing its equal share and the theoretically perfect point permits easier penetration. A drill sharpened this way has the stamina to deliver more holes before resharpening. Less feeding pressure means savings on drilling machine repairs, power and transmission costs and the drills themselves.



OLIVER

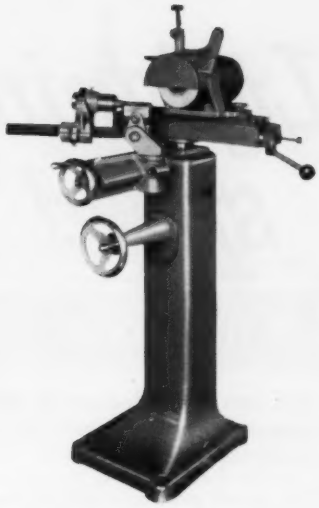
510 DRILL POINTER

Operation is semi automatic . . . covers the entire range of drill sizes from ¼″ to 3″ diameters . . . grinds two-, three- and four-flute drills and all point angles from 82° to 160° included. The form of the point is controlled by a master cam which may be varied to produce the proper clearance for the material being drilled.

OLIVER

21 DRILL POINTER

. . . a precision machine for small drills and built to machine tool standards. Drills are located in a jig before grinding for positive set-up. A definite setting produces the desired grind each time—accurately and uniformly. The machine may be mounted on a bench or a pedestal.

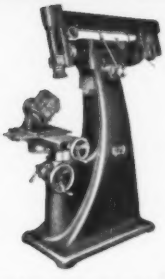


OLIVER

DRILL POINT THINNER

. . . designed for conventional point thinning and other work such as deep hole drill thinning, notching, chip breaking, clearing out flute and many other thinning operations. The machine is completely universal, easy to set up and operate. It is a natural companion to the 510 drill pointer.

More **OLIVER** *of* **ADRIAN** *Tool Grinding Equipment*

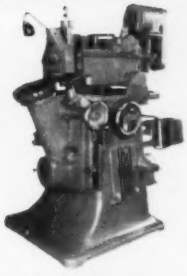


"ACE" TOOL-CUTTER GRINDER

Universal—grinds wide range of milling cutters and other cutting tools. Especially suited to grinding tungsten carbide.

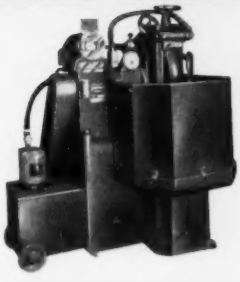
DIE MAKING MACHINE

Built to produce dies, gages, cams, templates, stripper plates, etc. at greatly reduced costs. Five designs in two types.



FACE MILL GRINDER

The only completely automatic grinder on the market. A machine tool designed for accurate grinding.



TEMPLATE TOOL BIT GRINDER

Controlled form grinding for high speed, stellite and tungsten carbide single point tools.

Just check the coupon for literature on the OLIVER of ADRIAN machine you are interested in. Send it today to . . .

OLIVER of **ADRIAN**

OLIVER INSTRUMENT COMPANY

1410 E. Maumee St. • Adrian, Michigan

- ☐ Drill Pointer
- ☐ Face Mill Grinder
- ☐ "Ace" Universal Tool and Cutter Grinder
- ☐ Literature only
- ☐ Die Making Machine
- ☐ Drill Point Thinner
- ☐ Template Tool Bit Grinder
- ☐ Quotation requested

NAME_____

COMPANY_____

STREET_____

CITY_____ ZONE_____ STATE_____

Lightning fast speed change

a money making virtue!

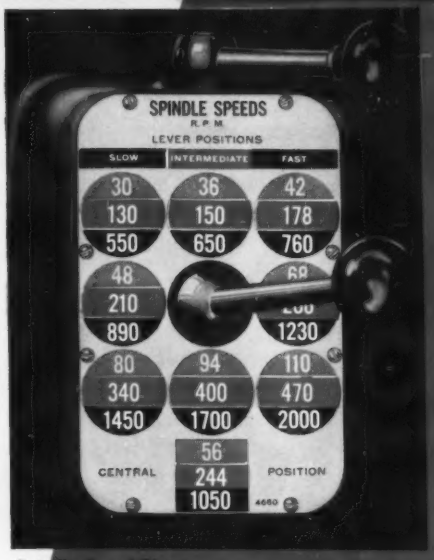
This time saving feature of "AMERICAN" Pacemaker Lathes appeals strongly to operators who acclaim it a real money maker for them.

The speed plate is direct reading and shows at a glance the available spindle speeds and how to secure them. Operators can't go wrong. So fast, so easy to read and so simple that they do not hesitate to make speed changes to secure correct cutting speeds.

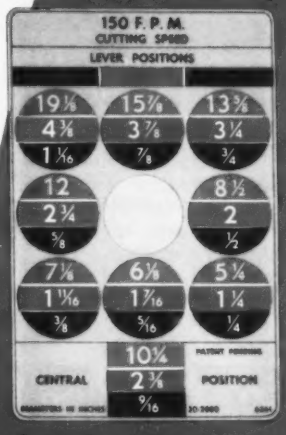
In addition, cutting speed snap-on plates are available indicating the lever positions for cutting various work diameters at the selected feet per minute cutting speed. These plates may be quickly applied and changed for the desired cutting speed.

No system for securing cutting speeds could be simpler, faster or less expensive in first cost and maintenance.

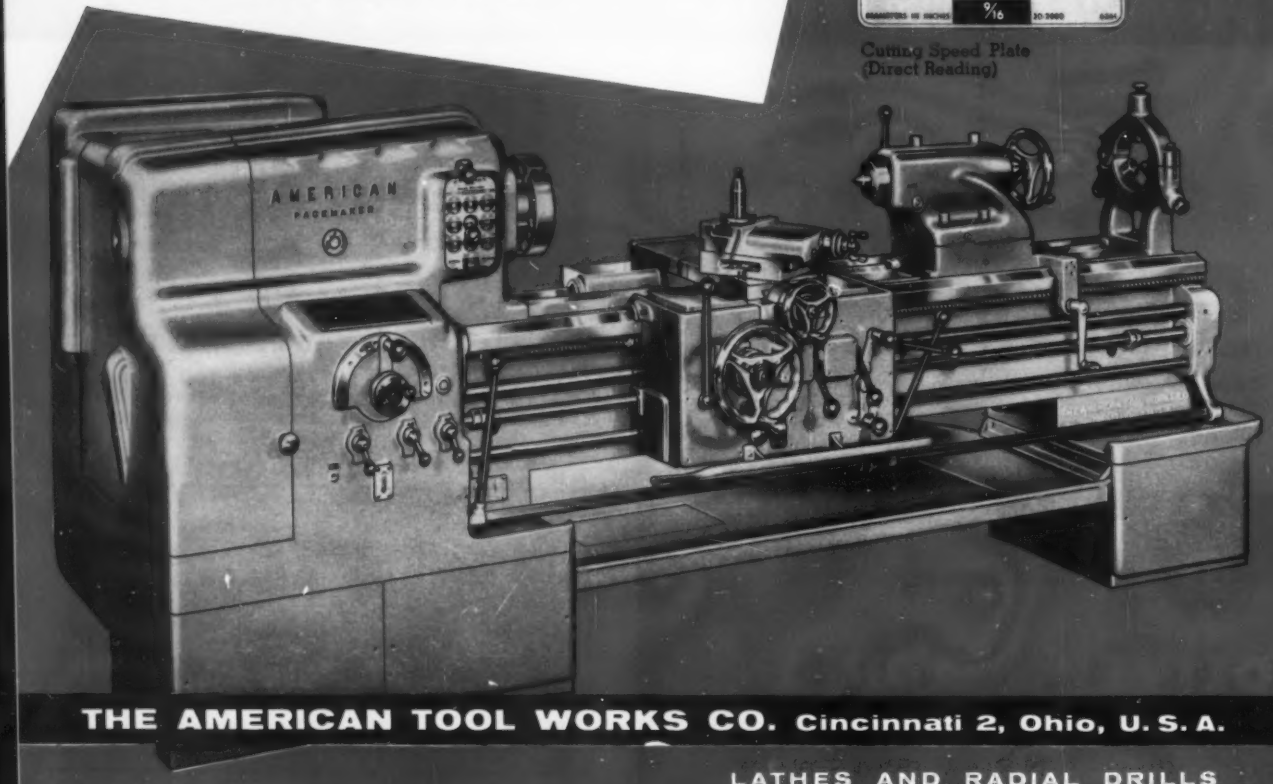
- *These and other fine features of the "AMERICAN" DeLuxe Model Pacemaker are illustrated and described by Bulletin No. 116.*



Spindle Speed Plate (Direct Reading)



Cutting Speed Plate (Direct Reading)



THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

- Trade Mission Exhibits Machines
- Export Financing Plan Needed
- Depreciation Guide Revision Slow
- School Need for Surplus Tools Surveyed
- Washington Briefs

Keeping up with Washington

Loring F. Overman

MACHINE TOOL INDUSTRIES are well represented at the U. S. Trade Mission exhibit scheduled for December 10 to January 10 at New Delhi, India.

The machinery exhibit—providing American manufacturers with an opportunity to explore export requirements and affording industrial India a close-up of American methods—has been assembled with the assistance of Niels Olsen, director, Metalworking Equipment Division, Business and Defense Services Administration.

Conducted in conjunction with the U. S. Department of Commerce Trade Mission Program, the exhibit will include twenty-one manufacturing areas, six of which are in metalworking machinery and allied fields. Machinery-industry representatives believe all six areas can make constructive contributions to India's economy.

Representing machinery on the Trade Mission are two Chicago men: Wallace E. Carroll, president, American Gage & Machine Co. (former director of the Metalworking Division, BDSA), and Herbert Harig, president, Harig Mfg. Corporation.

Trade Mission members will spend nine weeks in India, visiting most of the cities in the New Delhi area. The project, if as successful as anticipated, will be repeated in Calcutta next spring, in Bombay next fall, and in Madras in the spring of 1960.

Export Financing Plan Needed

Niels Olsen of BDSA was encouraged by the interest which machinery people have expressed in the New Delhi mission and exhibit. He was enthusiastic over the business possibilities of the India venture, and others which may follow. Most important, he was hopeful that India's reaction to the Trade Mission might be a factor in setting a pattern for long-range financing of machinery, machine tools, and other major items which overseas nations need and want to buy.

"Possibly the principal obstacle to export sales—dollar credits—might be bridged," he suggested, "by working out some government-guaranteed plan for private capital to handle long-term discountable paper covering the purchase of machine tools and other capital equipment.

"This would require legislation and a revolving fund available for use as a backlog against political and other contingencies in the purchasers' countries. It is quite likely that such a plan could be substituted for some of the direct appropriations made under present plans for helping friendly nations."

Depreciation Guide Revision Slow

As this column goes to press, Internal Revenue Service was still giving no indication as to when or whether it would issue a long-expected revision of Bulletin "F"—the IRS guide to the useful life of buildings, machinery, and equipment.

Industry holds that Bulletin "F," unchanged since 1942, does not reflect current depreciation practices. As a result of months of hearings involving scores of industry committees, new and consistently shortened depreciation schedules have been recommended by business representatives.

Machinery industry spokesmen in Washington are concerned over the slowness with which tax people accept the view that rapid write-offs of capital equipment encourage early replacement and modernization. In turn, industry points out that stepped-up replacement would actually increase tax receipts by expanding the real tax base—the gross national product of industry.

School Need for Surplus Tools Surveyed

Metalworking Equipment Division of BDSA is highly pleased that its current surveys among educational institutions indicate a need for tens of thousands of government-owned tools, if and when they should become surplus.

To supplement similar inquiries made by other agencies, BDSA started its own survey early this year. These studies are having a twofold result. Besides spotting places where surplus tools are needed, the survey is stimulating interest among schools. Many not previously heard from are exploring the possibility of having their present equipment replaced with more modern machine tools.

BDSA spokesmen point out that assignment of surplus tools to educational institutions will serve industry in two ways—as an outlet for large numbers of out-dated but still-serviceable tools, and as a method of providing students with comparatively modern equipment on which to practice.

Washington Briefs

Machine tool manufacturers as well as makers of cutting tools found much of significance in a recent announcement by General Motors of probable early substitution of aluminum for iron in the fabrication of automobile engines.

The increasing interest in aluminum is regarded as "of considerable long-range economic and industrial significance." Engines lighter by 200 pounds will permit decreasing the weight of mountings, frames, tires, and other parts, company spokesmen indicated. They also conceded that new, but not impossibly difficult, machining problems will follow.

Urgency of the situation was indicated by the announcement that some passenger cars may be powered by aluminum motors as early as 1960.

"Machining Titanium, Part 2," is the title of a new report available at a cost of $2.75 from the Office of Technical Services, Commerce Department, Washington 25, D. C. (Order PB 131536).

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Machinery
DECEMBER 1958

If You Do Not Have the Cash!

THOUSANDS OF SHOPS throughout the metalworking industry are operating under the handicap of inefficient, obsolete machine tools and allied equipment. Needless to say, profits in such shops are much less than they would be if the out-of-date machinery were replaced with modern equipment.

The top brass in every shop and plant recognize this fundamental principle of economics. However, if a program of modernization seems unfeasible in their own establishments because of various factors, the idea is usually discarded as being Utopian so far as they are concerned.

Generally speaking, failure to replace low-profit-making equipment is due to the lack of a big reserve of available funds. Decisions resting on such a consideration can be faulty because of the means available for buying capital equipment with a low down payment. Quite a number of machine tool builders have established leasing plans whereby new equipment can be bought with only a minimum initial investment. Banks, insurance companies, and other financial institutions will make somewhat similar arrangements.

Purchases involving part down payment on machine tools should not be confused with installment buying in the sense that the term is used in connection with the buying of automobiles, household appliances, and other commodities that become a financial liability the moment the buyer accepts delivery. The big difference is that the new machine will generally pay for itself in the increased profits it will earn. Machines costing as much as $20,000 to $50,000 apiece have paid for themselves in two years from profits over and above those earned originally with the equipment that was replaced.

Right now, with the recession rapidly becoming past history, would seem an appropriate time for shops to evaluate, on the basis of their individual needs, the potential advantages of low, initial-cost plans. With smaller backlogs of orders than in past years, machine tool builders can give immediate attention to special requirements and insure early deliveries. But most important, metalworking shops low on monetary reserves for equipment buying can avail themselves of the opportunity to increase their competitive advantages and prepare for the prosperous days ahead.

Greater productivity, higher accuracy, and lower setup time are potential advantages. Modern machines *can* "pay their own way!"

Charles O. Herb

EDITOR

A new problem facing steel users today

The danger of losing money by relaxing inventory controls

When the slump set in last year, big inventories were one of the toughest problems for most companies.

Now, as the economy swings back, these problems may seem to have disappeared. Actually, the problems of inventory cost and risk are always with us—just as much a threat to profit in good times as in bad.

But with the urgency of strict economies reduced, there is a very real danger that many companies will be caught off guard—a danger that recession-born practices will be abandoned as temporary emergency measures without careful enough analysis of their profit potential.

For example, companies that modified their steel inventory policies to avoid long-term commitments found that many costs were reduced and their needs better served. By taking advantage of the stocks offered by steel-service centers, these companies were able to release working capital for more productive purposes, free valuable storage space, reduce handling costs and lower scrap losses, insurance, taxes, etc.

Proof in dollars and cents

Those who carefully weighed all the advantages found reason for a *permanent* modification of their previous buying practices. They proved to themselves that they could and should rely much more heavily on steel-service centers because it makes sense in dollars and cents.

This conclusion is especially sound when you consider the unusually broad scope of Ryerson stocks and the speed and dependability of Ryerson services. Any kind, shape and size of steel can be shipped to you from Ryerson in a matter of hours. And your steel can be furnished in ready-to-use form, saving time and initial-cutting cost. You gain complete flexibility to meet quick shifts in production schedules. And you have the added assurance of getting steel of uniform, high quality—the unequalled dependability of Ryerson *certified* quality.

Your Ryerson representative is well qualified to review the facts and help you get the maximum value for your steel buying dollars. Ask him to analyze your requirements with you the next time he calls.

What it costs to carry inventory

IRON AGE magazine says: "*A survey of eight plants shows that, for every $100 worth of materials bought, the average yearly inventorying cost is $19.37.*"

Other authorities say the real cost of steel placed in inventory for extended future use may be as high as 40% more than the invoice price.

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AUTOMOTIVE PRODUCTION NUMBER

Vol. 65 No. 4 MACHINERY DECEMBER, 1958

EDGAR ALTHOLZ
Associate Editor

Ford's New Transmission Plant — the Plant of the Year

TOP HONORS as motordom's most impressive manufacturing addition of the year go to the Ford Motor Co.'s automatic transmission plant in Sharonville, Ohio. An array of modern machine tools is complemented by material-handling, storage, and inspection equipment that operates virtually as automatically as the transmission itself. Production of the transmission parts examined here typifies the "hands off" manner in which work is processed from start to finish. One of the best examples is the manufacture of planet pinions.

Each transmission has three short and three long pinions, made on two parallel lines. Stock consists of cold-drawn chromium-steel bars. Initially, automatic bar machines drill, ream, chamfer, face, form, shave, break down, and cut off the material into blanks. The machines in each line discharge their pieces onto a common belt conveyor—the start of an elaborate material-handling, washing, and storage system installed by the Gear-O-Mation Division of the Michigan Tool Co.

Elevated and shunted across an aisle, the blanks roll down a track into a continuous type

Fig. 1. Inspection station in the center checks and counts the pinion blanks after initial machining on a bar automatic and a washing operation.

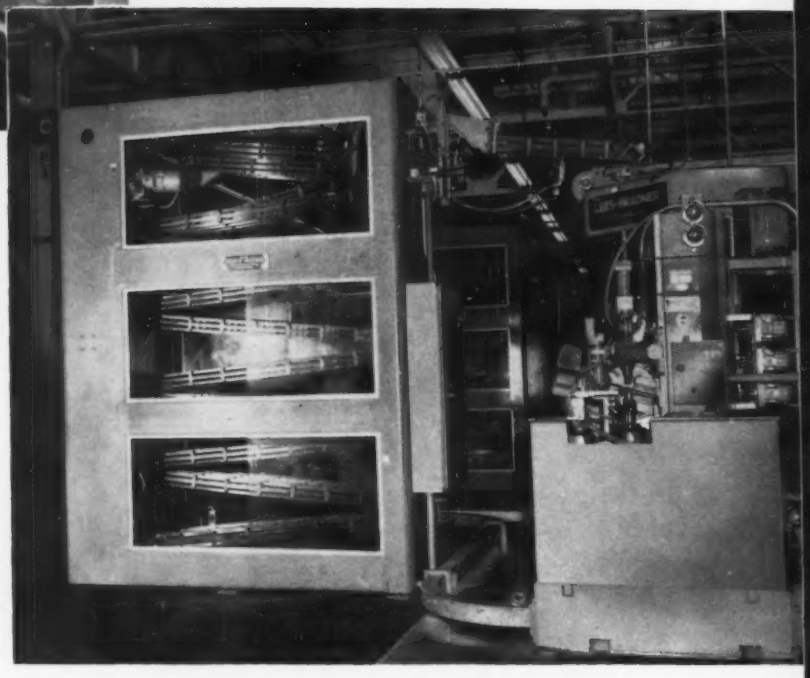


Fig. 2. A zigzag storage unit feeds pinions on demand to the hobbing machines. One unit serves two rows of machines.

washer. A hot-water spray removes the cutting oil left by the sequence on the bar automatics, after which the blanks are dried by a hot-air blast, emerge from the washer, roll down to an in-line inspection station, and then to a storage unit.

The arrangement of this equipment is shown in Fig. 1. In the center is the Sheffield inspection station. To the right, the end of the washer and its discharge chute are visible; and to the left, part of the storage unit.

Zigzag Storage Units Pace Pinion Production

As the blanks enter the inspection station, they are automatically oriented for the gaging and the subsequent machining steps. Various air gages, operating together, check each piece for bore and outside-diameter size and concentricity, and bore squareness with the chamfered pinion face. Accepted blanks actuate a production counter and roll into the storage unit. Those that are rejected are diverted to a basket before reaching the counter.

Both the short-pinion line and the long-pinion line have several of the storage units, characterized by a zigzag track design. In addition to the two that receive accepted blanks from the in-line inspection stations, others are located immediately ahead of the hobbing machines, like the one seen in Fig. 2. Blanks roll into the units through an opening in one end near the floor. An elevator raises them to the top of the cabinet, where they roll onto the first of five zigzag tracks. After each blank traverses the first track, rolling from top to bottom, it is re-elevated and rolls onto the second track, and so on, and finally exits from the unit through an opening near the top. A bypass permits the blanks to enter and leave the units without traversing the tracks, should the machines being fed increase their demand.

From the storage unit located after the in-line inspection station, the pinions are straddle-faced to length on the New Britain machine in Fig. 3. In addition, the bore and outside diameters are chamfered and a step is formed on one end. Four pieces are handled simultaneously.

Above and to the left of the machine the blanks

can be seen rolling down a chute. At the end of the chute they drop into a loading chamber. The machine cycle starts when four air cylinders positioned near the chamber each thrust a blank laterally into a web-like arm. The arm then pivots 90 degrees, locates a blank on each of the four spindles of the machine, then returns to its original position.

Four tool-blocks, carrying two carbide-insert cutters apiece, move into position next to their respective spindles (which now revolve), and feed as a unit. The cutters straddle-face and chamfer on the forward stroke. On the return stroke, a cam and roller arrangement forces one of each pair of cutters inward to produce the required step. When the tool-blocks have been retracted, the blanks are released from the spindles, and pick-off fingers transfer the pieces into runways, from which they roll onto a common chute and then to other storage units.

Pinions Keep Fifty-Five Hobbers Busy

A total of fifty-five machines are kept busy hobbing the pinion teeth. The short pinions, requiring thirty-one helical teeth, are hobbed on twenty-seven Lees-Bradner machines. The long pinions, requiring nineteen helical teeth, are hobbed on twenty-eight Cleveland machines. The equipment is arranged in seven rows of seven machines and one row of six. There is one storage unit ahead of each two rows, as in the heading illustration.

Blanks are diverted and fed automatically to each of the hobbing machines on demand. As can be seen in the close-up view of one of the Cleveland hobbers, Fig. 4, material-handling is completely automated. New blanks are delivered from a chute above the machine upon signal of a previously hobbed blank as it rolls into an exit chute seen in front. After a blank is hobbed and before it rolls into the exit chute, it is retained in a storage section for spot-inspection checking. The work-spindle is a tapered arbor which is expanded hydraulically when loaded.

To prolong tool life, the hob on each machine is shifted automatically after each piece. When a predetermined number of blanks have been completed, a light on the machine signals a hob change. Another feature of these machines is an attachment on the column which automatically deburrs the pinion at the point of hob breakout.

Fig. 3. This machine automatically loads, straddle-faces, and chamfers the outside and bore of four pinions at a time. Air cylinders one above the other on the left of the equipment are part of loading mechanism.

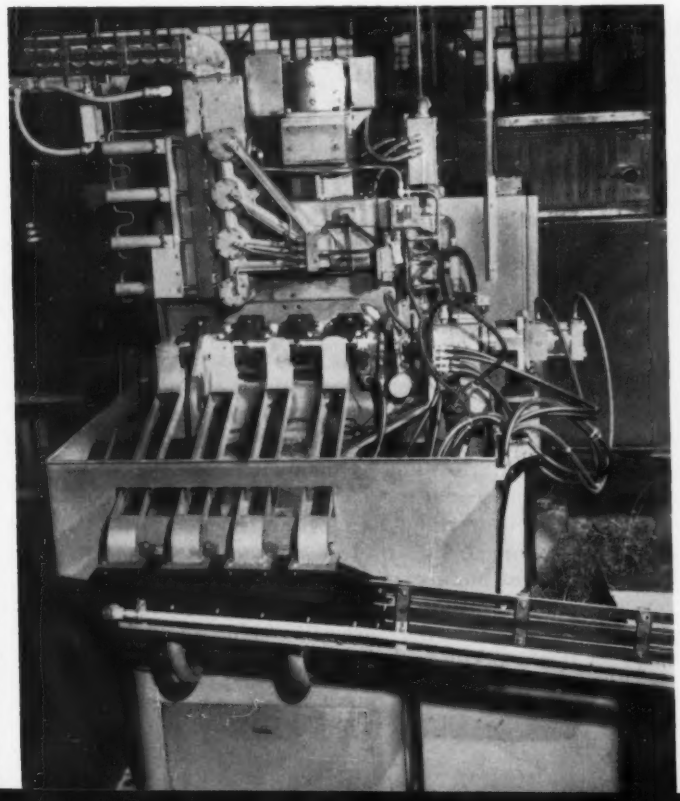
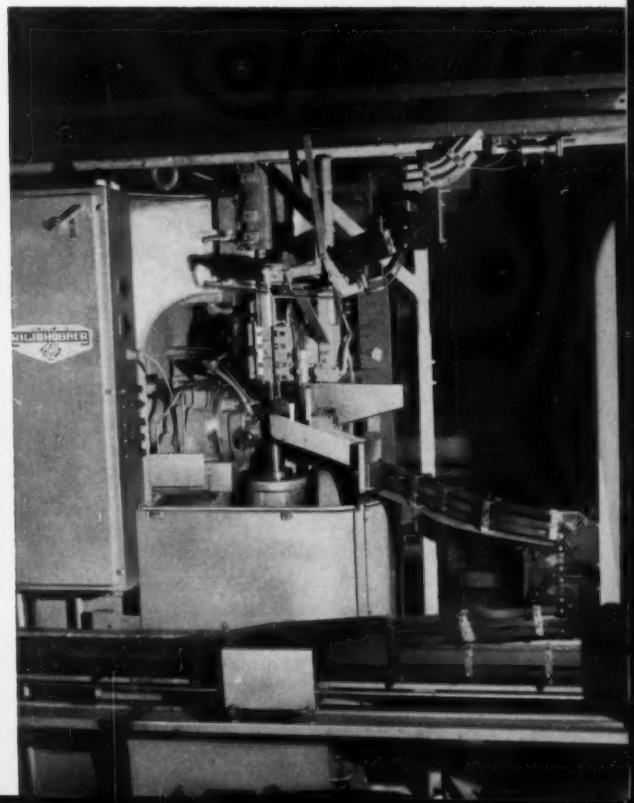


Fig. 4. One of twenty-eight machines hobbing the long pinions. Diverted on demand from feeding chute above machine, the pinions roll into exit chute in foreground after being hobbed.



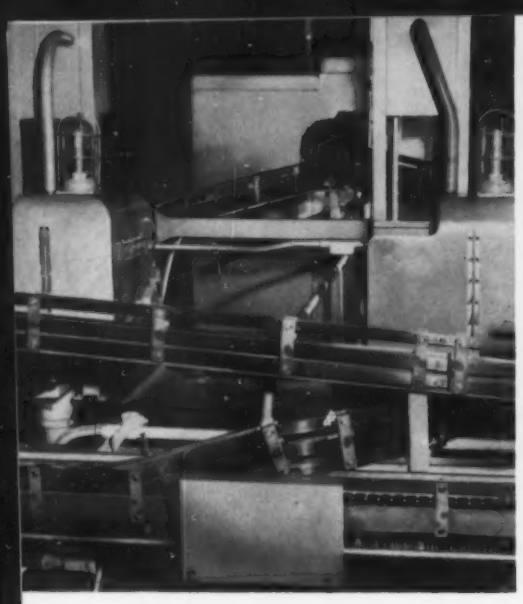


Fig. 5. Pinions go through washer located centrally at end of each two rows of hobbers, then return to gear checkers, one for each row.

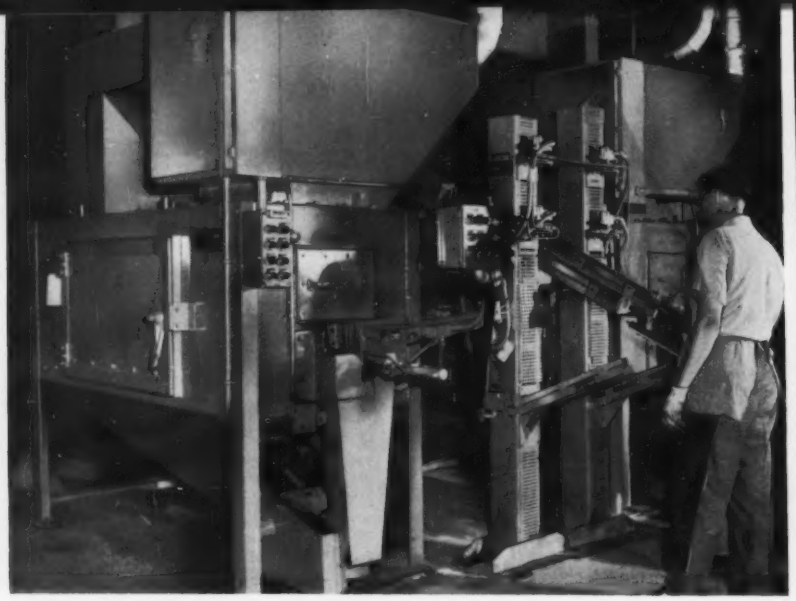


Fig. 6. Automation in shot-blasting operation elevates work to the cabinet entrance, conveys it through cabinet, then elevates it to top of incline in back of equipment. From there, pinions roll down to the front.

The exit chutes of each two adjacent rows of hobbing machines converge at continuous type washers, where the pinions are cleaned prior to inspection. Fig. 5 shows the chutes extending from one of the washers to two of the inspection units. It can be seen that the chutes remain physically separated within the washer, being arranged one above the other. In this way, all the pinions coming from one row of hobbing machines are directed to the same inspection unit (there being one unit for each row), and a hobbing machine producing a rejected pinion can be more readily identified.

Pinions Checked Between Handling and Shaving

The inspection units are Red Ring (National Broach & Machine Co.) gear checkers. Pinions travel down an incline in the chute, passing between and meshing with a motorized master gear and a non-rotating master gear. Both the pitch diameter and the helix angle are checked. On top of each unit is a light which goes on when a piece is rejected. Inspecting the pinions in this manner after they are hobbed assures that in the subsequent shaving operation only a small amount of stock will be removed, and avoids cutter damage from oversize work.

Chutes from the checkers direct accepted pinions to zigzag storage units (like the one in Fig. 2) where they are fed on demand to a battery of crown-shaving machines. Two of the five Michigan Tool universal finishing machines which crown-shave the short pinions appear in the heading illustration. At the upper left of the illustration can be seen a section of the diverter system and the path of the chute to the first machine.

When the gear reaches the bottom of this chute, it is directly above the shaving cutter and held between an air-operated headstock and tailstock. Both the headstock and tailstock are fitted with stub arbors which move in centrally to grip the work. After shaving is completed, the arbors retract and the work rolls into an exit chute. The long pinions undergo similar processing on a battery of six Red Ring gear shavers.

Washing and checking operations like those already described follow, and the pinions are "basketized" and put through a pusher type furnace where they are casehardened. Shot-blasting in the Pangborn equipment seen in Fig. 6 follows.

The operator unloads a row of five pinions from each of the heat-treating baskets into the two lower chutes seen in front of him. Elevators raise the work to where it can roll into the doors of the shot-blasting cabinets. Here it falls on a continuous belt. Cleaning is completed by the time the pinions reach the back of the cabinets. On emerging, they are again elevated, and move down an incline to the front of the equipment.

Grinding and honing, next in the sequence of operations, are performed with the same degree of automation as is the "green" machining. A chamfer is ground on both ends of the teeth, and

an oil groove ground in the thrust faces. Bores are semifinished and finished on two-station honing machines. Another washing, and the pinions move in sequence through two rotary surface grinding and honing machines, where the ends are squared and over-all length established. Pinion-making ends when the work traverses and a final continuous washer and automatic checker.

The relatively few people required on the two pinion lines have control of quality as their principal duty. A set percentage of pieces from each machine is checked on each work shift, and whenever a cutter or hob is changed.

Near the lines is a well-equipped analytical gear laboratory. In Fig. 7 is shown one of four Red Ring gear speeders in the laboratory that are used to check pinion noise level after the crown-shaving operation. The pinion being tested runs in mesh with a master gear in one direction and then is reversed. By means of a horn over the spindle, the operator is able to detect any rise in the noise level caused by an error in the tooth geometry, or a nick.

Fig. 7. (Above) Operator checks noise level of pinions by listening through horn on gear speeder in analytical gear laboratory. Pinions rotate in two directions in mesh with a master gear.

Valve Bodies Machined on Transfer Lines

One of the most precise parts of an automatic transmission is its valve body. In the Ford transmission, the lower valve body is an intricate aluminum die-casting requiring a variety of drilling, reaming, tapping, chamfering, and milling operations. By using in-line transfer equipment for machining this part, the Sharonville plant lays claim to an industry-wide manufacturing "first." The usual practice has been to use rotary indexing machines, which have to be hand-loaded, and which allow only a limited number of operations to be performed.

With the in-line equipment, the work is palletized mechanically, and there is less restriction on the number and nature of the machining operations possible. Errors due to relocating and realigning spindles to suit die-casting core shifts have been reduced. In addition, the new line has been made flexible enough to permit economical retooling, if and when engineering changes in an engine's horsepower require corresponding changes in the valve-body design.

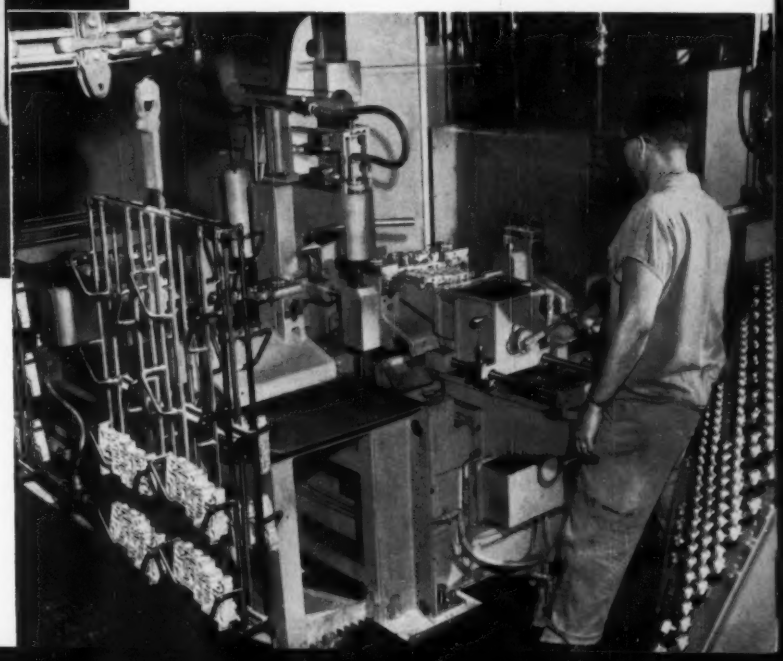


Fig. 8. (Below) Cast-aluminum lower valve bodies from qualifying operations are palletized at start of the transfer line—claimed to be the first such line for these parts in the industry.

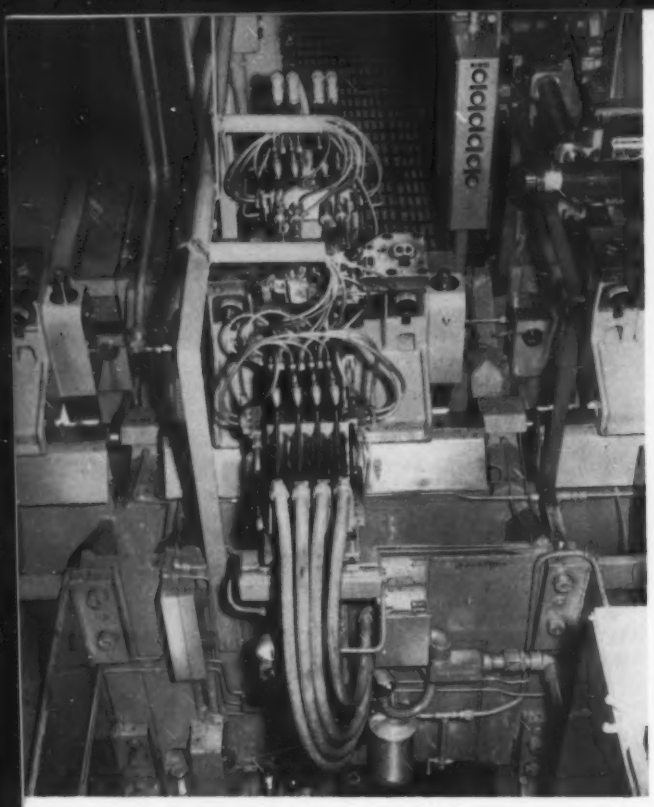


Fig. 9. At this gaging station in the second section of the valve-body transfer line, the diameters of eight different holes are controlled automatically to within plus or minus 0.0005 inch.

The transfer equipment, built by Heald, actually consists of two duplicate 100-foot long lines, each composed of two sections. The lines are laid out parallel and adjacent to each other, with a bypass provided between the sections. In this way, one section of a line can be "down" for cutter changing, and the other section can continue to operate by recirculating the pallets within itself.

Each line has forty-four stations, performing 171 different operations on fifty-seven holes or surfaces in the part. The loading station on one of the lines is illustrated in Fig. 8. On the left, racks suspended from a monorail transport valve bodies to the station from previous qualifying operations.

Loading of the pallets—each line has ninety-four—is semi-automatic. After the part is located over two dowel pins, an air-motor operates a screw which clamps it to the pallet. (The operator need never put his hands inside the pallet.) A lubricating device automatically greases the linkage.

All drilling and tapping are done in the first section. In the second section, the valve bores are core-drilled, rough-reamed, and finish-reamed; and the body faces are fly-cut. Cam-fed heads are used on the drilling, reaming, and tapping stations, and hydraulically fed heads are used on the valve-boring stations. Immediately ahead of the unloading station, the parts are flushed with coolant, then blown off with air and run through a detergent washing station in the return line.

At a station between the two sections of each line, fifteen drilled holes are probed by Sheffield air gages as a means of protecting the reamers. The probes are hollow, and air is blasted through them to clean out the holes as they enter. The probes detect tools that are broken off, and also assure that the holes have been drilled to full depth. Another in-process gaging takes place within the second section, where the diameters of eight holes are checked. A close-up view of the air spindles of the Sheffield equipment performing this check appears in Fig. 9. Here, too, hollow construction of the spindles permits an air blast to dislodge the chips. An elaborate console of lights indicates the condition of each of the holes.

Internal and Surface Broaching Combined

An unusual integration of broaching in an automated processing line occurs in the production of converter stator-clutch outer races for the transmission. Involved is the broaching of an internal cam contour and four external slots. A drawing of a broached part appears in Fig. 10.

Originating as chromium-steel tubing, the work goes through a preparatory series on six-spindle bar automatics, is washed, stress-relieved, tumble-blasted, rough-ground to width, and semifinish-ground on the outside diameter. Material-handling is completely automated.

The races then are directed down a chute and are diverted to either of two duplicate 25-ton Detroit pull-down broaching machines. A close-up view of one of them appears in Fig. 11. (Two of the broached races can be seen near the front of the machine table.)

The heart of the material-handling device is a shuttle which advances the work through the stations of the broaching machine. Its movement is illustrated in the drawing in Fig. 12. There are three pairs of jaws in the shuttle, each of which closes around a work-piece when it is to be advanced.

From a feed tube, the work drops into the shuttle at Station 1. Then it is indexed to the left until it is in position beneath the first of two internal broaches, at Station 2. In the cycle, the broach enters the part, engages its puller, and

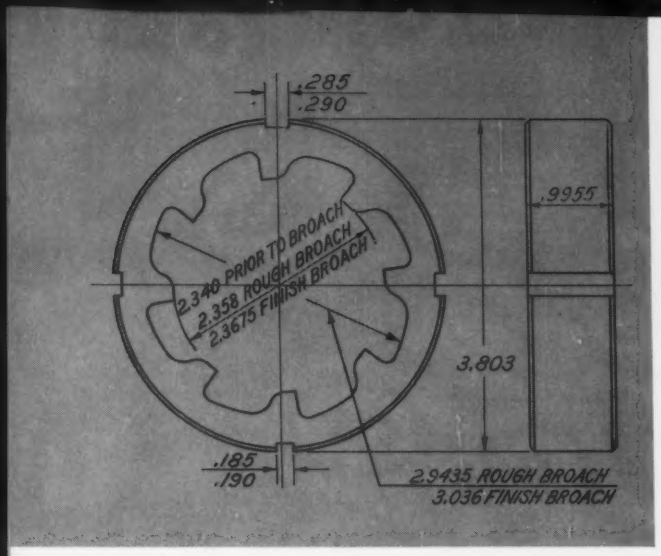


Fig. 10. (Above) Close radial relationship between the internal cam contour and the external slots of the outer race is maintained by combining the broaching operations in one setup.

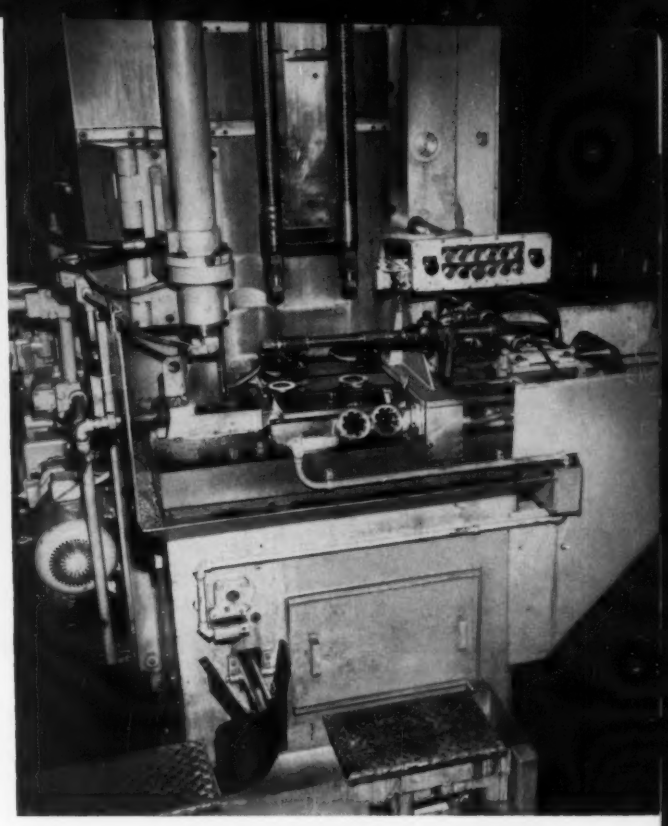


Fig. 11. (Right) Two internal broaches are pulled through the part for internal cam contour, then part is pushed through pot type broach for external slots.

continues to the bottom of its stroke, roughing out the internal cam contour. The part is then indexed to an intermediate point between the broaches, which then retract. When the part is indexed beneath the other internal broach, at Station 3, its contour is finished in a similar manner in the second cycle.

For the four external slots, the part is again indexed to the left, this time beneath a hydraulic cylinder at Station 4. Then, in the third cycle of the machine, the part is pushed through a pot type broach and ejected from the chute seen in the front of the machine, Fig. 11. To maintain a definite radial relationship of the slots with the cam contour, the part is located on the finished internal surface during the broaching of the slots. Meanwhile, the shuttle has returned to the left and a new part is received at Station 1.

Production is continuous, there being one work-piece under each of the two internal broaches and another under the hydraulic cylinder at the same time. Thus, a completed race rolls down the exit chute seen in front of the machine in each cycle.

Ford's concept of automatic processing, which is in full evidence on the various machining lines,

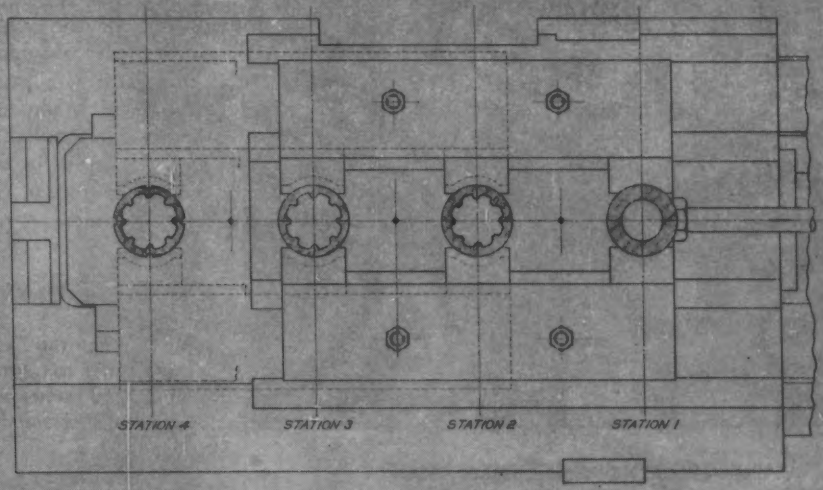


Fig. 12. The shuttle is shown in solid outline to the right, with its three pairs of jaws closing on work-pieces at Stations 1, 2, and 3. When moved to left (shown in broken outline), work-pieces advance to Stations 2, 3, and 4.

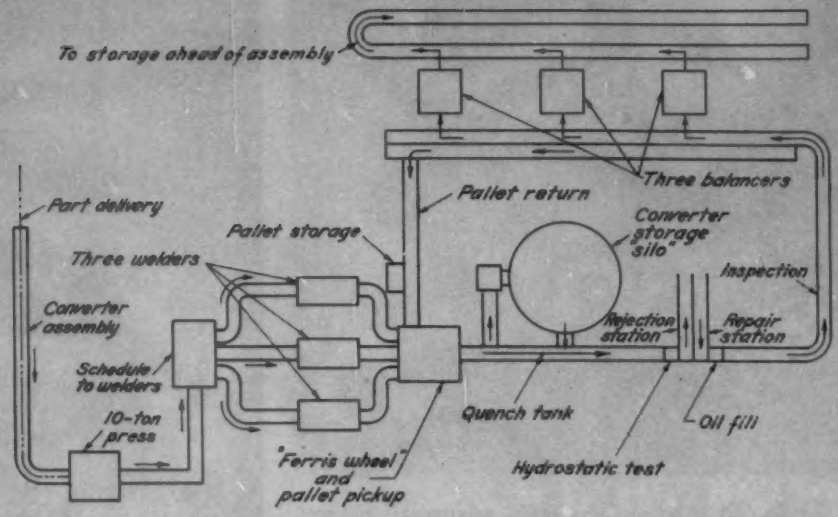


Fig. 13. Diagram of work flow along the converter assembly line. Operations include pressing, welding, hydrostatic testing, inspecting, and balancing.

is reflected to the same degree in other phases of transmission manufacturing. Welding, testing, and balancing of converter assemblies, for example, bear out this fact. A diagram of the work flow appears in Fig. 13.

The assembly consists of the blades and turbine in the converter housing, and the sub-assembly of the impeller, one-way clutch, outer race, and inner race. After the impellers have been placed in the housings, the latter move down a conveyor belt to a press. There, a cover plate is automatically pressed on, and the assembly advances on demand to one of three Allied welders (one appears in Fig. 14) where the housing and cover are seam-welded together.

Approaching the welder, the housing moves onto an air-operated fixture which then tilts upward to the welding head. Simultaneously, a motor in the fixture base rotates the assembly through one revolution, the welding head advances, and a bead is laid down in an arc shielded with CO_2 gas.

Fig. 14. When the fixture tilts upward, the housing starts to rotate and the welding head moves into position, laying bead down in shielded arc.

"Ferris Wheel" Inverts Converters; "Silo" Stores Them

In Fig. 15 can be seen the subsequent movement of the work. As it emerges from the back of one of the welders, the assembly enters a "Ferris wheel" which turns it upside down. Then the assembly is palletized and placed on a conveyor which moves it through a quench tank, where it is cooled. The welded converters can then be stored in the "silo" seen on the right in the illustration, or continued through subsequent operations.

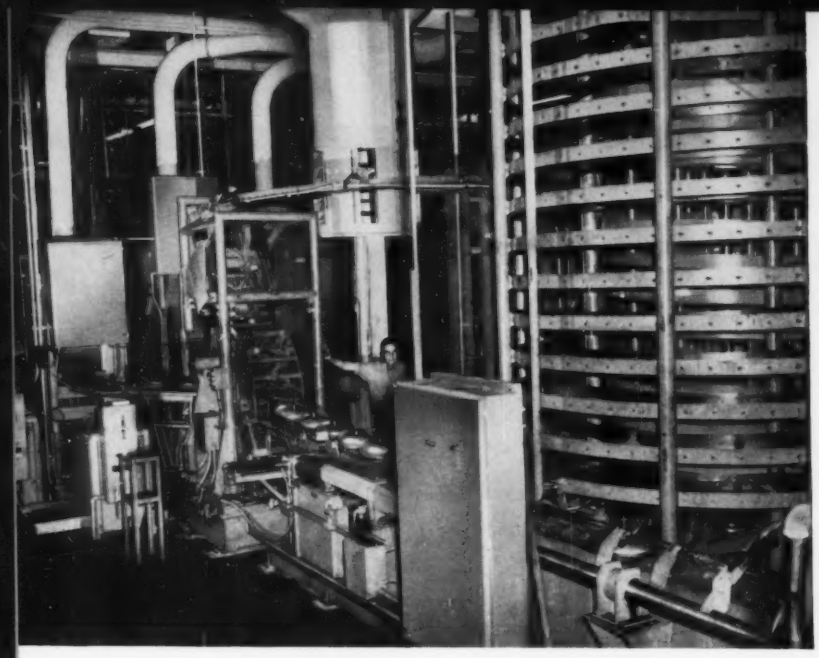


Fig. 15. "Silo" on right stores assemblies between welding and hydrostatic testing operations. Assemblies leaving welder are first inverted by ride on "Ferris wheel."

Later, the assemblies return to the conveyor and proceed to a hydrostatic testing station. Assemblies are tested in tanks. After the inside of the hub is sealed, air under a pressure of 90 psi is introduced through a fitting. Any air bubbles in the water indicate a defect in the weld or porosity in the housing.

Accepted assemblies are filled with oil, then, by means of photoelectric cells, are directed to one of our GM Research balancing machines. One of them appears in Fig. 16.

The angle of unbalance is indicated on one gage, and the corrective weight required, on another gage. Tied in with each balancer is a Progressive welding unit. The arms of the welder are loaded with steel weights which the operator spot-welds at the appropriate point on the converter rim. Unloading of the work automatically onto the belt conveyor in the foreground completes the cycle. The pallets remain on the conveyor and are returned to a storage elevator near the Ferris wheel, as can be seen in Fig. 13.

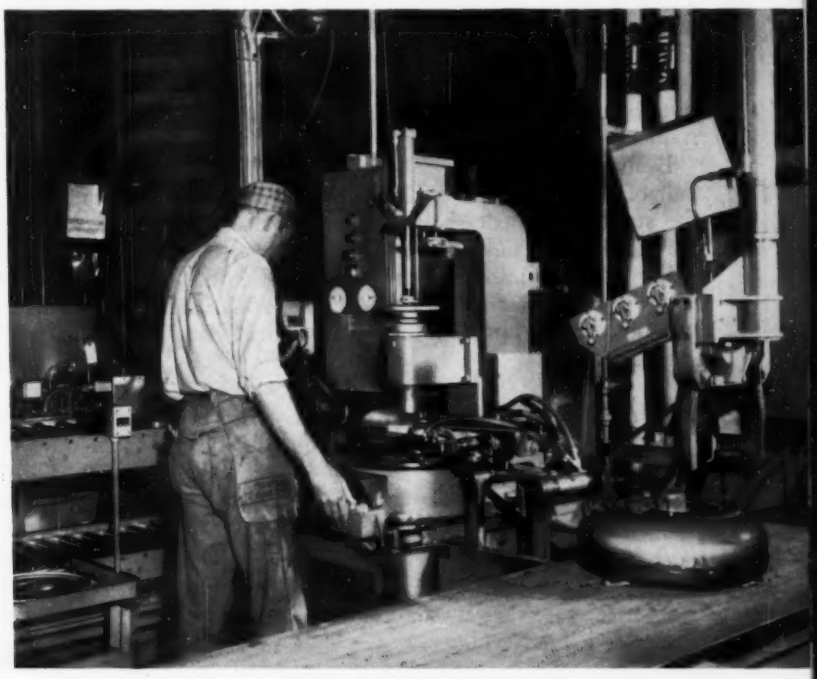


Fig. 16. For balancing, converters are first filled with oil to simulate service conditions. Welding head swings over work while still on balancer.

Oldsmobile Axle-Shaft Line Rolls Smoothly

RAYMOND H. SPIOTTA
Associate Editor

Banks of standard machine tools, linked together by a well-planned conveyor system, are producing rear axle-shafts in a continuous flow. In most instances loading and unloading of individual machines are performed manually in an efficient manner.

FORGED-STEEL AXLE-SHAFTS used on the greatly redesigned 1959 Oldsmobile are streaming from a well-balanced production line in Lansing, Mich. Although it cannot be considered completely automatic, this line does provide a smooth material flow from unmachined forging to rear axle-shaft sub-assembly, and does incorporate some fully automatic and semi-automatic sequences.

Delivery of the SAE 1038 steel forgings to a pair of company-built centering machines marks the start of the axle-shaft line. These machines are loaded and unloaded manually. Spindles at either end feed into the work—the spindle at the flange end of the forging center-drills, while the spindle at the opposite end center-drills and spot-faces.

Multiple Diameters Tracer-Turned on Automatic Lathes

After being removed from the centering machines, the parts are placed on hangers suspended from a trolley type chain conveyor. They then travel to a bank of six automatic lathes where the body diameters are turned. Included in this group are four Hydra-Feed double tracer lathes and two Seneca Falls, Model AQ, automatic tracer lathes. Both types function in the same general manner, perform the same sequence of operations, and have identical tooling.

An axle-shaft is shown being turned between centers in the heading illustration. In this operation the body diameters are roughed and finished in one setup, making a second-operation machine unnecessary. At the start of the machining cycle two rear carriages feed in (one at each end of the forging) and rough-turn the two areas. Immediately thereafter, two inclined slides riding on overhead carriages advance into the work. Feeding from right to left, one slide finish-turns the clearance, oil-seal, and bearing diameters at the flange end, while the second slide faces and chamfers the small end, finish-turns the spline diameter, forms a relief groove behind this diameter, and finish-turns a clearance diameter. These various surfaces are identified on the axle-shaft seen in Fig. 1.

Each of the two top-mounted slides is controlled by an individual flat template—the tem-

plates and styluses (not visible in illustration) are located above and behind their respective slides. All tooling is carbide. During finish-turning, a 0.020-inch-deep cut is taken at a feed of 0.018 ipr (inch per revolution) and a speed of 350 sfm (surface feet per minute).

Driving Splines are Cold-Formed

Turned axle-shafts are transferred by hand to either of two continuous-chain conveyor lines leading to a pair of Model 1537, Michigan Roto-Flo machines. One of these can be seen in Fig. 2. It is here that the 1.82-inch-long involute splines are cold-formed on the drive end of the 30 1/2-inch-long shafts. Each conveyor carries fixtures which support the work-pieces at two points. Limit switches control its advance, thus providing an automatic indexing movement that will not permit a blank shaft to enter the loading position until the previously rolled shaft has been cleared.

As the shafts are indexed to the loading position, the spline diameter—which has been held to a tolerance spread of 0.0015 inch—contacts a specially designed, fixed sizing gage. If an oversize condition is detected, that particular line will automatically shut down so that the offending shaft can be removed. Excess metal on the blank diameter would most likely lead to an oversize pitch diameter, major diameter, or both. Should the blank diameter exceed its tolerance limit by any great amount, extreme pressure build-up will occur during rolling, with tool damage as the probable result.

An L-shaped fixture is suspended from the feed-slide beneath the machine over-arm. A groove in the lower (horizontal) leg of the fixture engages the bottom edge of the shaft flange and pushes the part into the work area. The small end of the shaft passes through a guide bushing and contacts a center behind the forming racks. The spline diameter is now in rolling position. A

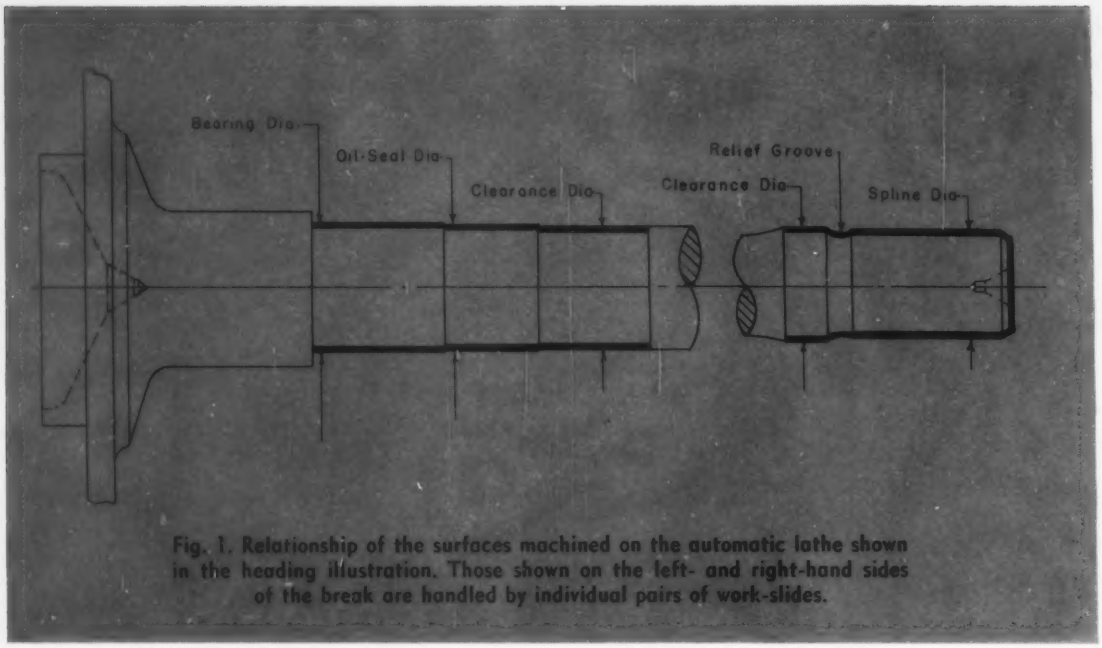


Fig. 1. Relationship of the surfaces machined on the automatic lathe shown in the heading illustration. Those shown on the left- and right-hand sides of the break are handled by individual pairs of work-slides.

second center, carried by the feed-slide, then engages the opposite end of the axle-shaft, lifting the flange just enough to clear the fixture groove.

The upper and lower rack type forming tools are driven toward each other by individual hydraulic cylinders, causing the work-piece to rotate about its own axis while the spline teeth are cold-formed. Accurate timing and relationship are maintained between the forming tools by a single connecting gear that rolls in contact with an integral timing rack on each of the two slides. Electrical interlocks delay the work stroke until the shaft is properly positioned and, after rolling, delay the return stroke until the shaft has been removed.

Including the time required for indexing, loading, rolling, and unloading, splines are formed on approximately 360 axle-shafts each hour. This rate applies, of course, to each of the two lines. The forming racks are made of molybdenum-tungsten tool steel and average 50,000 parts per grind. They can be reground five or six times before being discarded.

Shafts Hardened by Induction Heating

After the spline-rolling operation shown in Fig. 2 has been completed, the axle-shafts are redeposited on the conveyor. They are then carried through a Ransohoff washing unit to remove all traces of oil, cutting fluid, and metal particles prior to heat-treating.

The chain conveyor extends through the washer to induction-hardening machines, one of which can be seen in Fig. 3. Here, the entire shaft—from the front of the splines to the back of the flange—is progressively hardened. Each machine accepts four shafts at a time, the work-pieces being manually positioned between centers. Rotative movement is imparted to the shafts by driving fingers that engage a pair of lugs recessed into the hub (front) face of the flange.

When all four shafts are in place the machine cycle is started by the operator. The entire work-carriage is first elevated, carrying the shafts up through the fixed induction coils, Fig. 3. As inner flange faces draw near to the coils, the direction of carriage travel is reversed and the coils are energized. Water is piped to a series of jets in quench rings *A* that encircle each of the four coils. The water is then sprayed downward, flooding the heated area.

There is an interesting sidelight to this operation. In reflection, it should be mentioned that the blank axle-shafts are cold-straightened before leaving the forge shop. As a result, they tend to bow when brought to an elevated temperature. To counteract this tendency, restraining rolls (two of which are designated *B*) are provided on the drive end of the work-carriage.

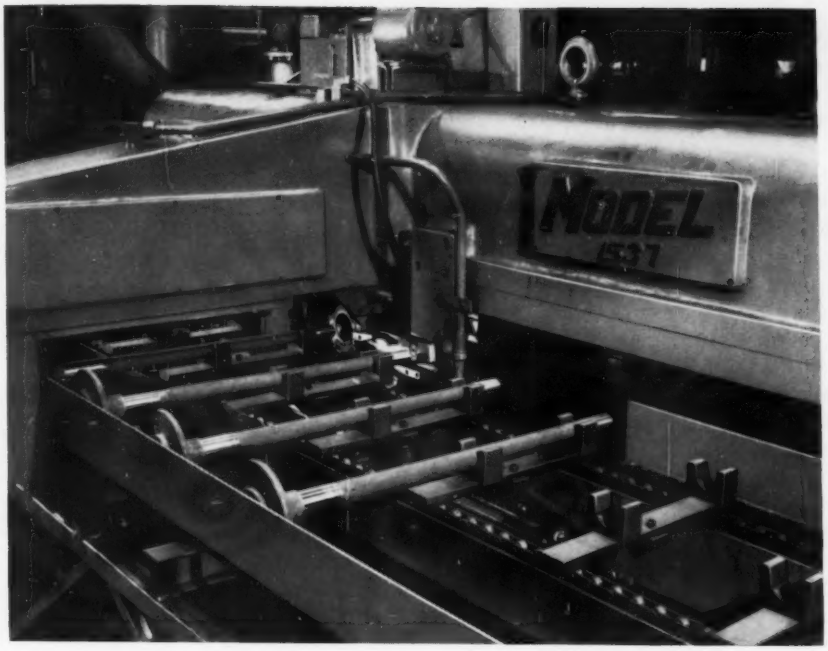


Fig. 2. (Left) Continuous-chain conveyor carries turned axle-shafts to this spline-rolling machine. Complete sequence of movements, which include conveyor indexing, loading, cold-forming, and unloading, are controlled automatically. Sizing gage ahead of loading position checks spline diameter.

Fig. 3. (Below) Progressive-hardening of axle-shafts on an induction-heating machine. Four such installations handle the full flow of shafts. Restraining rolls (B) maintain pressure on the rotating work to prevent distortion while it is heated.

At the start of the heating cycle, the restraining rolls are inclined away from the work-pieces to avoid interference with the induction coils and quench rings. When, during the downward movement of the shafts, the oil-seal diameters pass through the coils, hydraulic cylinders below the carriage force the restraining rolls into contact with this machined area. Constant pressure of the rolls against the hot, rotating shafts prevents unwanted distortion.

Another trolley type chain conveyor carries the hardened axle-shafts to, and through, a Wayne draw furnace. The parts travel through the furnace slowly. In the course of their journey they are brought to a temperature ranging from 450 to 500 degrees F. and maintained at that level for forty minutes. The result of this step is a shaft uniformly hardened to a Rockwell C number from 45 to 52, and to a minimum depth of 0.100 inch.

Axle-shafts are given a 100 per cent inspection for hardness and straightness on the company-built, dual-purpose check stand shown in Fig. 4. A shaft is first placed on V-blocks at the rear of the stand. When this is done, the penetrator of a Size 4 Wilson automatic Rockwell hardness tester (mounted at the back edge of the stand) is lowered into contact with the bearing diameter and the test load is applied. In addition to the standard dial, a small panel of three indicator lights (green, amber, red) is fixed to the upper

housing of the Rockwell unit. Indicator lights are especially valuable in this application, as the operator's attention is divided between the hardness test on the shaft at the rear of the stand and a runout check on another shaft at the front.

Centers engage the ends of the axle-shaft at the forward location. While thus supported, two gaging heads contact the shaft—one at the clearance diameter immediately behind the splines, and one at the oil-seal diameter. Fluctuations of the gaging heads are read on dial indicators extending from the front of the stand. One indicator can be seen (bottom, center) in the illustration.

Runout is checked by manually rotating the shaft. Variations of up to 0.010 inch T.I.R. (total indicator reading) at the spline end and 0.020 inch T.I.R. at the flange end are permissible. When the indicator readings have been noted, the right-hand center is retracted and the shaft removed. A pneumatic cylinder is then triggered to actuate a pair of unloading fingers. With a pivoting motion, the fingers contact the rear shaft, lifting it out of the V-blocks and pushing it onto inclined ways leading to the forward check position.

If excessive runout is found, that shaft is transferred to a 25-ton Fox hydraulic straightening press. Approximately 10 per cent of the shafts now require this step. Previously, when the blanks were batch-hardened in furnaces at the forge shop, 100 per cent of the shafts had to be straightened before final machining.

Form-Grinding and Contour-Turning Complete Shaft Machining

Three final machining operations on the shaft consist of rough-grinding, flange-machining, and finish-grinding. In the first of these, the bearing and oil-seal diameters are rough-ground, Fig. 5, on a bank of four Cincinnati No. 3 centerless grinding machines.

Plunge-grinding is employed, with the 24-inch diameter grinding wheel running at 1090 rpm (6850 sfm) and the regulating wheel running at 23 rpm (95 sfm), yielding a work-piece rotation of approximately 250 rpm. A coolant of soluble oil and water mixed 20 to 1 floods the work area. The regulating wheel is set to provide a feed rate of 0.080 ipm with 0.010 inch of metal being removed. A Sheffield air snap gage is used to check the ground diameters.

As the bearing and oil-seal surfaces are not of the same diameter—although the difference is only 0.009 inch—the 2 1/2-inch wide face of the grinding wheel is step-dressed. The path of the diamond dressing tool is controlled by a hydraulic follower-head riding in contact with a flat metal template at the left of the grinding wheel. Dressing cycles are initiated manually at intervals of approximately twenty-five pieces.

Flange-machining is the next step for the axle-shafts. This is done on a bank of six 12-inch Fay automatic lathes (Jones & Lamson). The lathes are arranged in three groups of two, each pair being handled by one operator.

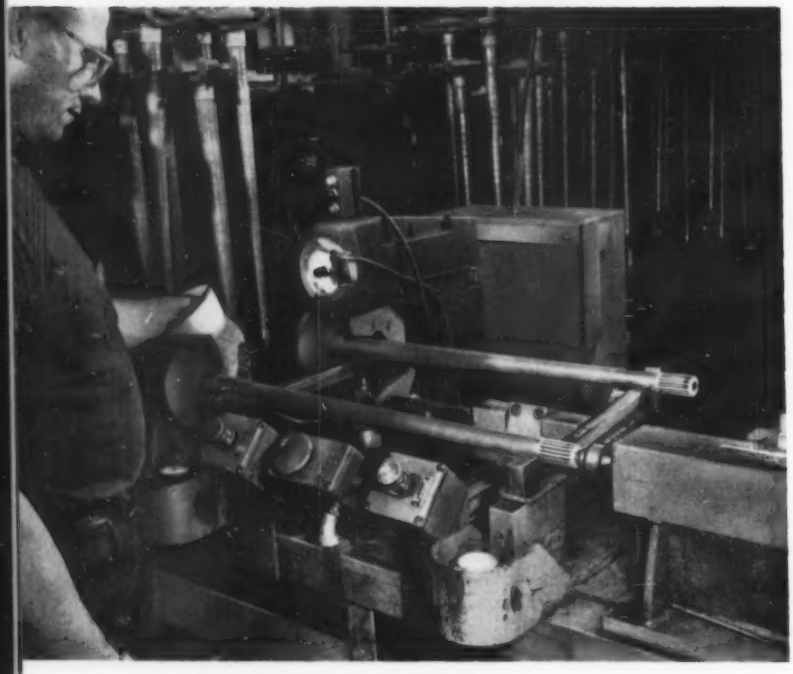


Fig. 4. Two-position check stand is used to determine hardness and straightness of all axle-shafts. At rear position, automatic hardness tester contacts bearing diameter; at forward position, gaging heads indicate runout at both ends.

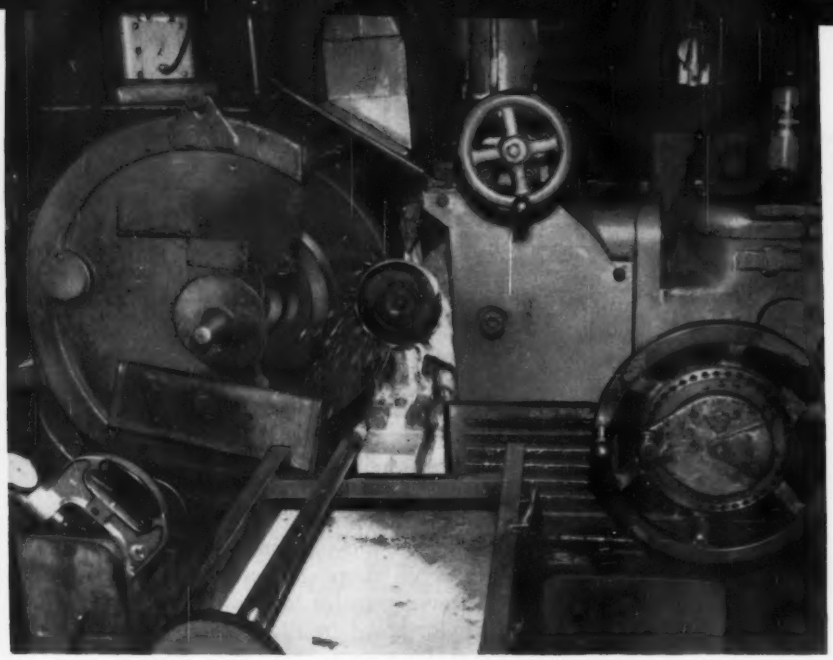


Fig. 5. Oil-seal and bearing diameters are being rough-plunge-ground on a centerless grinding machine. Because the two diameters are not the same, the grinding wheel is step-dressed by a template-controlled diamond tool.

In loading the machine, the small end of the work-piece is inserted into the hollow spindle until the shaft splines engage internal driving splines. An air-operated, mechanical diaphragm chuck then grips the shaft on the bearing diameter. With only the flange end exposed, Fig. 6, there is little overhang, and consequently no noticeable deflection of the part under tool pressure.

Three carbide tools are carried by the tool-block on the roughing carriage at the rear of the lathe. At the start of the operation, the roughing carriage feeds to the left while one of the three tools rough-turns the hub (wheel pilot) diameter. When this is done, the carriage and tool-block pivot back to clear the work, then move a short distance to the left to bring the remaining two tools into alignment with the flange. In the next movement the tool-block swings forward and rough straddle-faces the flange.

One single-point carbide tool is set in the tool-block on the finishing carriage at the front of the lathe. It comes into action immediately after the roughing carriage has completed its cycle and has

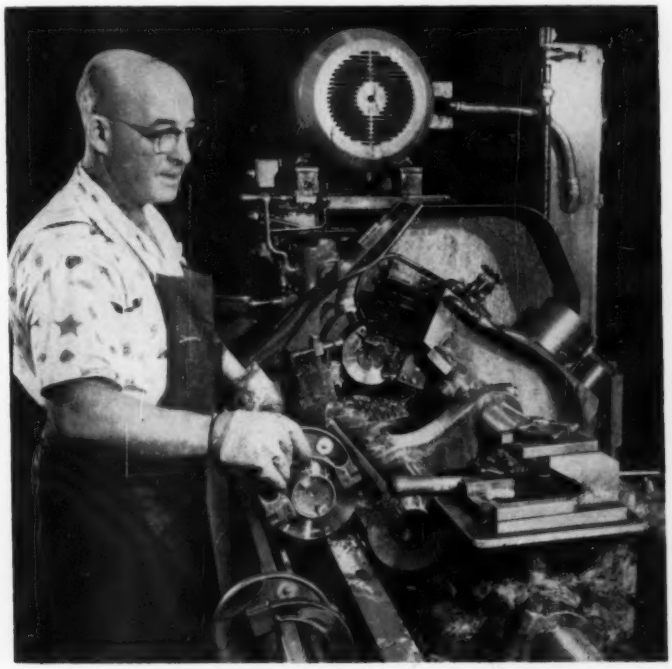


Fig. 6. One of six automatic lathes that are employed to rough- and finish-machine the flange and the hub. Only the flange end protrudes from the diaphragm chuck, resulting in no noticeable deflection under the cutting load.

been retracted. The single tool is pivoted into the work, taking a finishing cut across the outer flange face. When the infeed limit is reached, the front carriage travels to the right, causing the tool to finish-turn the hub. These cuts are made at a speed of 660 sfm with a feed of 0.020 ipr and a maximum cut depth of 0.020 inch. No finishing cut is taken across the inner flange face.

Bearing and oil-seal diameters are finish-ground on a pair of Cincinnati No. 2 centerless grinding machines. The techniques used here are the same as those used for the rough-grinding operation already described. Axle-shafts are plunge-ground at the rate of 0.071 ipm with a 20-inch diameter, step-dressed wheel. With the wheel running at 1200 rpm, a surface speed of approximately 6300 fpm is obtained. The bearing diameter is held to a tolerance of 0.0006 inch, and must be concentric with the oil-seal diameter within 0.001 inch T.I.R.

Semi-Automatic Assembly Follows Flange Drilling

Five flange holes are drilled, reamed, and countersunk to accommodate wheel-mounting studs. These operations are all carried out on a special, five-station, Cross dial type machine at the rate of 168 axle-shafts per hour. Each of the stations handles two work-pieces, a total of ten shafts being contained by a fully loaded machine.

Station No. 1 is reserved for loading and unloading. Two shafts are placed vertically in the fixtures, flange end up, and manually clamped around their bearing diameters. At the second station a multiple-spindle head drills five 0.578-inch diameter holes. To assure required concentricity between the bolt-hole circle and the hub, or wheel pilot, each of the two work-holding fixtures floats independently. As the spindle-head lowers—but before the drills feed into the flange—it locates on the machined hub, pulling the fixture into alignment. This action is repeated at each succeeding station.

At the third station five 70-degree countersinks enter the drilled holes. High-speed steel reamers at Station No. 4 open the bolt holes to a diameter of 0.579 inch. The shafts are indexed to Station No. 5, which is idle, and then back to the first station where they are removed from the machine.

Axle-shafts undergo shop sub-assembly on a semi-automatic Beyer transfer machine, the first section of which is shown in Fig. 7. Shafts are placed flange end down on a pallet type transfer fixture (extreme left in the illustration). Proper positioning of the shaft is afforded by five swaging bushings pressed into the pallet fixture. Raised, chamfered ends of these bushings seat in the countersunk flange holes. A ring gage is slipped over the small end to check the splines before the shaft passes through the assembly sequence.

In addition to this loading and spline-gaging station, nine other work stations are provided, with several idle stations in between. At the second work station (shown enclosed by an expanded-metal guard cage) a multiple-spindle

Fig. 7. Axle-shafts are partially assembled on this multiple-station, semi-automatic transfer machine. After flange holes have been countersunk (within caged area), studs are dropped in place. A 400-ton press, right, swages the studs to the flange.

Fig. 8. Final station of the transfer type assembly machine, Fig. 7. Shaft is raised from its fixture by a center (bottom) and rotated by a splined spindle (top) while an abrasive belt (rear) polishes the oil-seal diameter. Note: the dust shield, bearing, and retainer are not included on this shaft for clarity of illustration.

drill head descends and forms a 0.020-inch by 45-degree back-chamfer in the five flange holes.

Headed studs are inserted by hand in the flange holes at the next station. After indexing past several idle stations, the shaft arrives beneath the ram of a 400-ton, mechanical Bliss press (right, Fig. 7). On the down stroke, the studs are trapped between a swaging die mounted on the press ram and the swaging bushings located in the pallet fixture.

At the two stations following stud-swaging, a dust shield and a sealed roller bearing are slipped over the shaft in that order. Another indexing movement of the transfer system brings the shaft in line with a unit that can best be described as a hydraulic arbor press. Here, the roller bearing is pressed onto the ground bearing diameter.

An inner bearing retainer is placed on the shaft at the next position. The retainer is also pressed on the bearing diameter—this being done by a second small hydraulic press at the subsequent location.

Both hydraulic presses incorporate safety pressure switches to prevent completion of the assembly step should the fit between the shaft and the added units fall outside of prescribed limits.

In the case of the bearing press, the safety switch is set for a maximum pressure of 350 psi. The purpose of this is to prevent damage to the bearing if the fit is too tight. Conversely, the safety switch on the retainer press is set for a minimum pressure of 95 psi. The object here is to prevent assembly of bearing retainers that fit the shaft too loosely. If the maximum limit on the bearing press is exceeded, or if the minimum limit on the retainer press is not reached, the entire assembly machine will automatically shut down.

After an idle location, the shaft is advanced to the final station, Fig. 8. At this point, the ground seat for the oil seal (this seal is not part of the shaft sub-assembly, but is first installed in the axle housing) is polished to remove any marks caused by pressing the bearing and its retainer and to improve the finish in general.

A hollow driving spindle is lowered from overhead and engages the shaft splines. From beneath the transfer table a center is raised into contact with the flange. The center continues its upward travel until the shaft has been elevated sufficiently for the studs to clear the swaging bushings in the fixture. While the shaft is rotated by the driving spindle, a 1-inch-wide abrasive belt, supported by a contoured backup plate, is held in contact with the oil-seal diameter.

IMPERIAL ASSEMBLY STRESSES QUALITY CONTROL

F. A. STEWART, Quality Control Manager
Imperial Division, Chrysler Corporation, Detroit, Mich.

AN INTEGRATED body building and assembly installation devoted exclusively to the manufacture of Imperial automobiles was recently placed in operation by the Chrysler Corporation. The installation has been set up in a completely revamped, single-story building in Dearborn, Mich., containing more than 1,000,000 square feet of floor space. Output can be varied up to twenty-seven automobiles per hour.

Among the outstanding manufacturing features of the plant are one of the most advanced statistical quality-control systems in the automotive industry and a fixed-station, zone type, progressive inspection system. Nearly 100 quality-control personnel and thirty-two stations have been provided to insure high-grade workmanship and optimum car performance.

The zonal system, with 100 per cent inspection at thirty-two stations, permits immediate detection and correction of quality defects as they occur along the assembly line, instead of letting them accumulate. Successive departments—body-in-white, paint, trim, final assembly, and sales—have the opportunity of either accepting or rejecting the product completed by the preceding department. Both roving process inspectors and line inspectors located at specific stations are employed.

Quality control is maintained by continuously gathering information pertaining to the quality of the product from the production line. Analytical engineers analyze, interpret, and chart trends based on these facts, and supply corrective recommendations to pinpointed areas in the shop. This

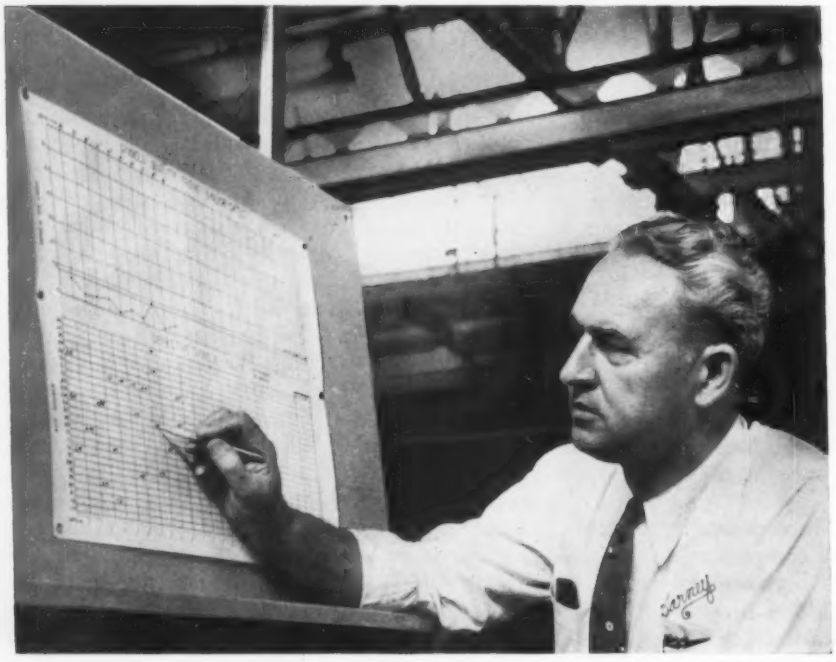
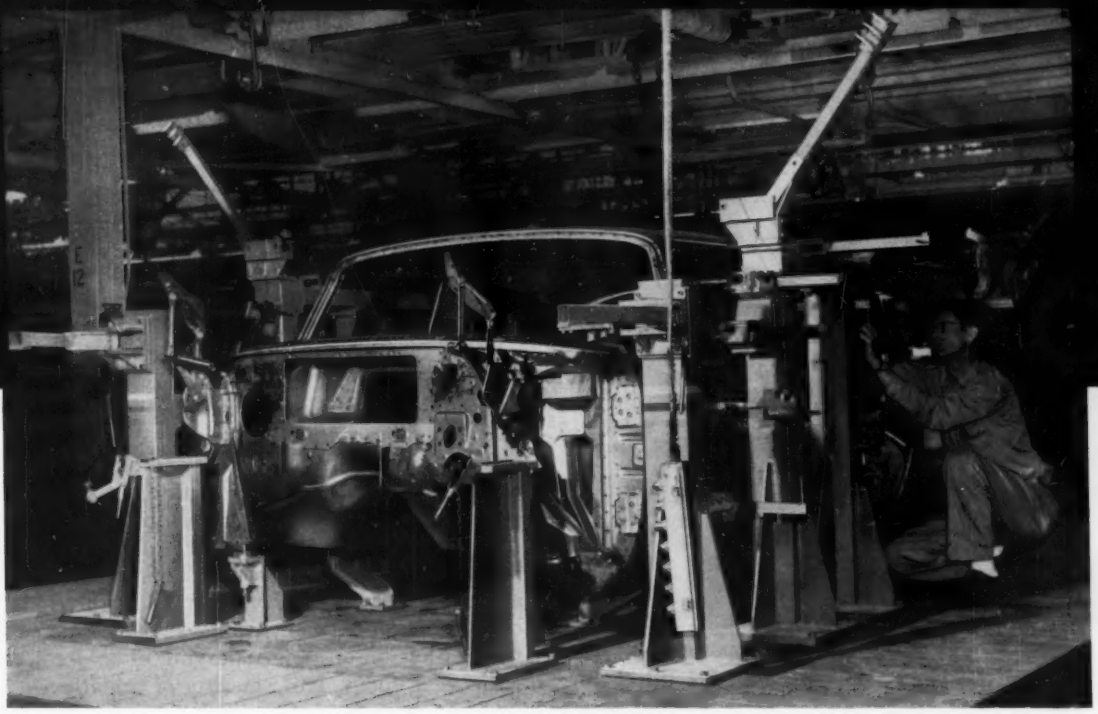


Fig. 1. Quality-control chart contains graph (top) of number of defects per inspection, and tabulation (bottom) listing the defects for each welding gun.



data is rapidly put to use in the form of daily quality-control charts and hourly tabulations.

Typical of the quality-control charts is the one shown being examined in Fig. 1. This particular chart shows the trend in quality of spot-welds on a particular body sub-assembly. The graph at the top is a plot of the number of defects found per check, while the tabulation at the bottom lists the daily number of defective spot-welds (both missing and broken) for each welding gun. The welding guns are individually numbered so that defects can be accurately traced to the source. At least twice a day test strips are welded with each gun and pried apart to determine whether the welds being produced are satisfactory. Also, all sub-assemblies are checked twice a day for each operation.

Receiving inspection plays an important part in maintaining quality because approximately 5000 various parts are obtained from about 2500 vendors. Acceptable quality level numbers, which indicate the size of sample and frequency of sampling required, are assigned to the parts, the number depending on how critical the function of the part is. Established quality-control methods of sampling are used. Many formed parts are checked by placing on plastic contour fixtures, as seen in Fig. 2. Also, laboratory facilities are available for periodic chemical, metallurgical, and physical tests with respect to composition, hardness, plating thickness, and similar specifications. Vendors are notified if their parts are rejected and whether they can be repaired.

An important adjunct to the inspection and quality-control system is the body layout room. Here, as shown in Fig. 3, initial and routine samples are inspected; sub-assemblies are fabricated to check out parts, jigs, and fixtures; and masters are made for production use.

Along the body-in-white production line, ten inspectors are provided for various functions. One checks sub-assemblies, such as front ends, cowl sides, quarter panels, roof rails, and wheel housings, with gaging fixtures to insure proper fit in framing. This man also makes sure there are no poor, missing, or broken welds on the sub-assemblies. Three more men check the brazing, and spot, arc, and gas welding performed on the gate and framing lines. Two additional men inspect for metal defects, and check the fit of the doors, deck lids, hoods, fenders, and fuel-tank filler tubes.

Another inspector checks the windshield, back window, and door openings by inserting exact-size plastic templates into these body-shell openings. (A windshield template is shown in place in Fig. 4.) The eighth man completes the body-in-white item check and stamps satisfactory bodies "O.K.," while the ninth relieves the other eight and sample-checks the various bolts and screws for proper torque.

The tenth inspector in the body-in-white department mans the master body-checking fixture

Fig. 2. Plastic contour fixture used to check incoming formed parts. Receiving inspection also makes chemical, metallurgical, and physical tests periodically.

seen in the heading illustration. On this fixture, known as the "R-1," the accuracy of linear dimensions, openings, and mating surfaces is checked on about 10 per cent of all Imperial body shells. Bodies are lowered into the fixture from an overhead conveyor, Fig. 5, locating from the floor-pan and securing by means of body bolts. After positioning and securing all gage points, the specified dimensions are checked by means of feeler gages and scales. More than 100 critical body dimensions are inspected, and the number of point locations checked vary from forty on convertible models to sixty-two on four-door sedans. Any variations from required dimensions are recorded on a tally sheet, and corrective action is immediately taken to adjust preceding operations. This fixture handles eight bodies a day, compared to several days required by a skilled layout man to check just one body.

Painting of the Imperials is an extensive, carefully controlled process, requiring about eight hours in the department for each car. An average of 4 gallons of primer, sealer, and finish paint are applied to each Imperial. The operations include alkali washing, water rinsing, phosphate coating, chromic-acid rinsing, acid cleaning and rubbing of solder joints, spraying of solder areas with clear epoxy, knife glazing of imperfections, priming, baking, water sanding, sealing, undercoating, and enameling. To maintain a dust-free atmosphere in the paint area, more than 1,500,000 cubic feet of air per minute are filtered. Three inspectors are employed to check the different operations and insure proper sealing and painting.

Fig. 3. Surface plates and various gages are used in the body layout room to inspect samples and fabricate sub-assemblies for checking jigs and fixtures.

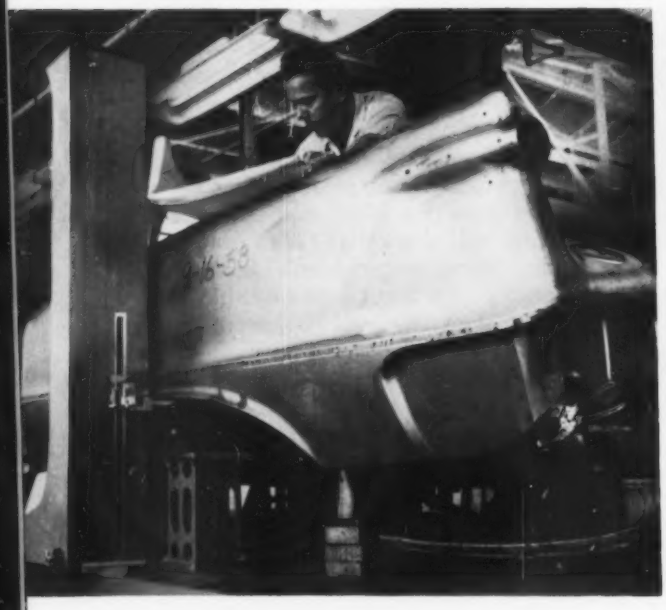
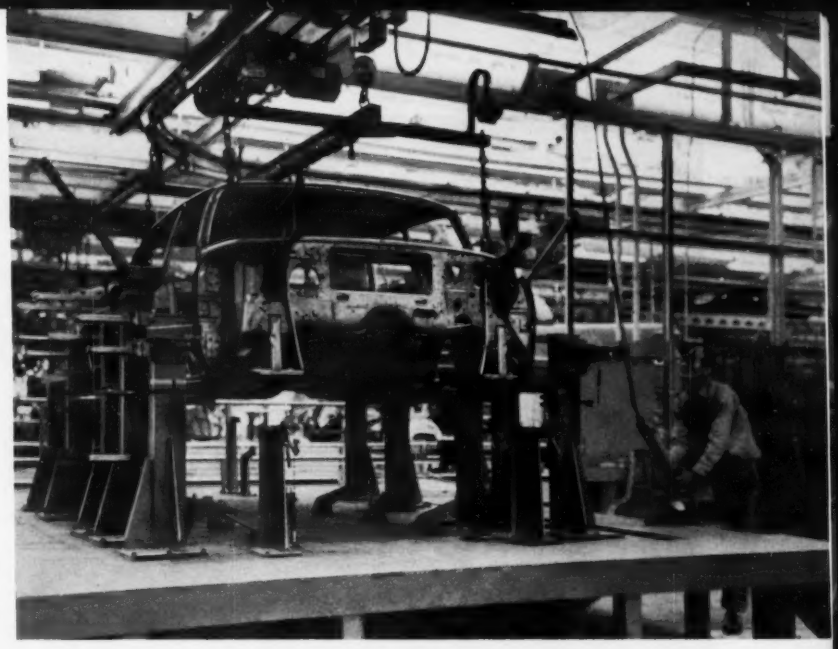


Fig. 4. Plastic templates called "plugs" are inserted in body-shell openings to insure that the windshields, back windows, and doors will fit properly.



Another production innovation insuring quality control in the Imperial plant is the provision of a water test booth, shown in Fig. 6, on the final line to check the water tightness of the car bodies. Termed a "rain-storm in a box," the 25-foot-long booth is equipped with 118 jet nozzles, 22 of them directed to the underside of the vehicles. The volume of water released during the test period in an accurately controlled pattern is equivalent to a rainfall of 252 inches per hour, with a pressure of 30 psi. A static water-test booth has been provided near the final assembly line for periodically spot-checking the efficiency of the production water-test booth.

Complete installation of air-conditioning units in the cars is done on a separate line having a specially constructed conveyor designed to facilitate charging and testing of the units. Included on this line is an insulated room in which the temperature and humidity are accurately controlled to check on the efficiency of the units under varying conditions. Another quality-control checking device on this line is an automatic leak detector or "sniffer." Any escaping refrigerant passes over a sensitive electronic element in the housing of the unit, which actuates a buzzer.

An inspection and repair tag is kept with each body as it progresses through the trim and final inspection departments. Spaces are provided on the tags for each item to be checked at the various stations. Any defects are listed, and the repairmen and inspectors check them off as they are corrected. The chassis is similarly handled.

Other quality-control checking devices include a power-steering inspecting fixture to insure proper centering and evenness of torque of the units. Also, a front-end and height alignment fixture is provided to check each car. Finally, a 100 per cent, road-test quality check is made of each individual car by four specially trained inspectors. The vehicles are driven over a variety of bumpy, rolling, and smooth road surfaces while the brakes, engine, transmission, axle, and over-all handling characteristics are tested.

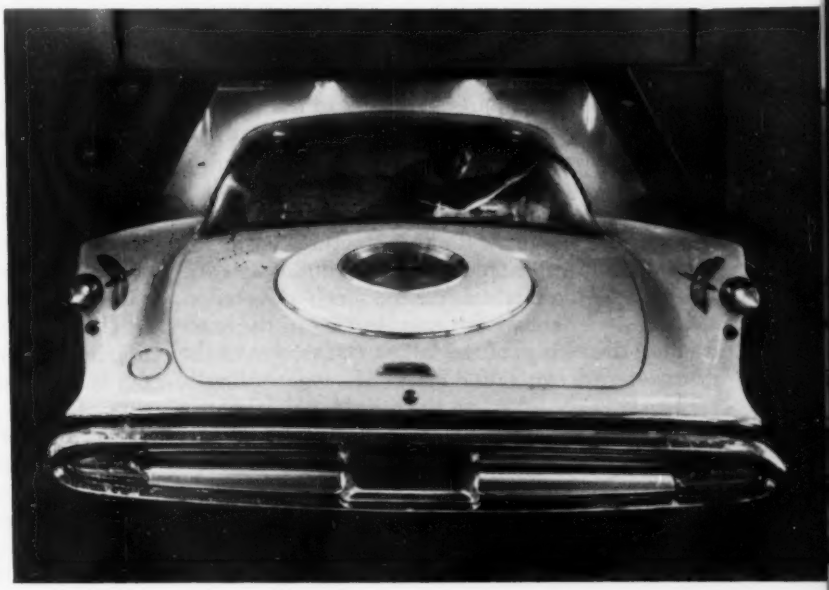


Fig. 5. (Above) Ten per cent of bodies produced are lowered into this master checking fixture. More than 100 dimensions are inspected by feeler gages and scales.

Fig. 6. (Right) Water tightness of bodies is tested by passing them through a 25-foot-long booth equipped with 118 jet nozzles arranged to produce desired pattern.

DISTRIBUTORS

EDGAR ALTHOLZ
Associate Editor

INDEPENDENT parts suppliers in the automotive industry operate in an economy of an unusually challenging nature. For, in addition to the normal competition among themselves, suppliers are often confronted with the prospect of competing with a plant of the manufacturer-customer. In such a "captive" plant, engineering design and manufacturing facilities can be nicely dovetailed. The designer knows the spindle sizes of the automatics, the swings of the lathes, the strokes of the presses—and can tailor his product accordingly.

The parts supplier, on the other hand, has little control over the manufacturer's product design. To bid low enough to land a contract, the supplier might have to rely on ingenious re-tooling to adapt its present equipment to the job at hand. Frequently, it has to invest in new machines, and has to do so without any assurance against the equipment being made obsolete at any time by engineering changes in product design. Further, while it is relatively simple to gear a captive plant to mass produce one part, the independent supplier must be flexible enough to produce it in all the variations in design that are dictated by the needs of its many customers, and to produce the part in small lots as well as in large volume.

The Electric Auto-Lite Co. is a prominent independent supplier of ignition and electrical components to the nation's largest industry. Production of its line of distributors is centered in the company's Stickney Avenue plant in Toledo, Ohio. Highlighted here are some of the manufacturing activities in this plant, to show how intelligent deployment of men and machines keeps this supplier very much in the competitive picture with respect to both price and quality.

Machining Complicated by Longer Stems

The distributor body is a gray-iron casting, received from the Auto-Lite foundry in Fostoria, Ohio. In the past, the distributor was mounted on the side of the engine close to the camshaft and required a lower section, or stem, of only about 1 1/2 inches. Today, most distributors are found on top of the engine, and in addition to stem lengths of 4 to 5 inches or more, the stems may have integral mounting flanges which further complicate the problems of machining.

For many of the bodies, initial machining consists of a series of operations on New Britain six-spindle chucking machines, one of which appears in the heading illustration. The five work stations of the machine do the following: (1) rough-face and chamfer, spot-drill, and rough-turn a bearing boss; (2) finish-face and finish-turn the bearing boss; (3) drill through the stem; (4) bore through the stem; and (5) turn outside diameter of the bell, bore inside of the bell, and ream through the stem.

One operator runs two machines. While these are cycling, the operator chamfers the back of the reamed hole on the previously completed piece. The heading illustration shows this activity in progress. A gear-motor powers a chamfering tool, which revolves within a tubular section. The operator enters the work in the tube, holding it against the tool.

Distributors on some engines have extra-long stems, so they are initially processed in a different manner to maintain the critical relationship between the stem and the bell. After the inside of the bell has been machined in a turret lathe operation, the work is brought to the Ex-Cell-O single-end Bor-Dril, shown on the right in Fig. 1. Here, a tubular-shank carbide tool held in the machine spindle gun-drills a 5/8-inch hole from the solid on a stem 6 3/4 inches long. The work is supported on a table which feeds hydraulically toward the revolving spindle. An expanding arbor inside the bell centralizes the distributor body, and an air-operated tailstock clamps it in position. During the gun-drilling, coolant under high pressure is forced through the shank of the tool. The hole is completed in a floor-to-floor time of thirty seconds, and held to a tolerance on the diameter of 0.001 inch.

Gun-drilled bodies are then loaded by the same operator in the Monarch Mona-Matic lathe, seen on the left in Fig. 1, and a tracer-controlled, single-point tool faces the stem end and turns two shoulders on the outside diameter. As in the gun-drilling, the work is located on the inside of the bell and clamped by an air-operated tailstock. On the headstock of the lathe can be seen a deburring attachment similar to the one at the chucking machine.

Bell End Completed on Dial Type Machines

Secondary operations on the bell end, which in the past were performed on individual machines, are now consolidated on Kingsbury dial type machines, with a net gain in machining time of 250 per cent. One of the Kingsburys appears in Fig. 2. The five work stations of this particular machine do the following: (1) mill the vacuum-chamber slot and drill the oiler boss part way; (2) complete the oiler-boss drilling and drill one nameplate hole; (3) ream and chamfer the oiler boss; (4) drill one vacuum-chamber bracket hole and (vertically) drill two drain holes in the bottom of the bell; and (5) tap one vacuum-chamber bracket hole and drill one cap-spring bracket hole.

All heads on the machine are cam-operated and are tripped pneumatically. In the illustration, the operator is shown at the loading-unloading station. After the distributor is positioned in its fixture on the table, an air cylinder operates a

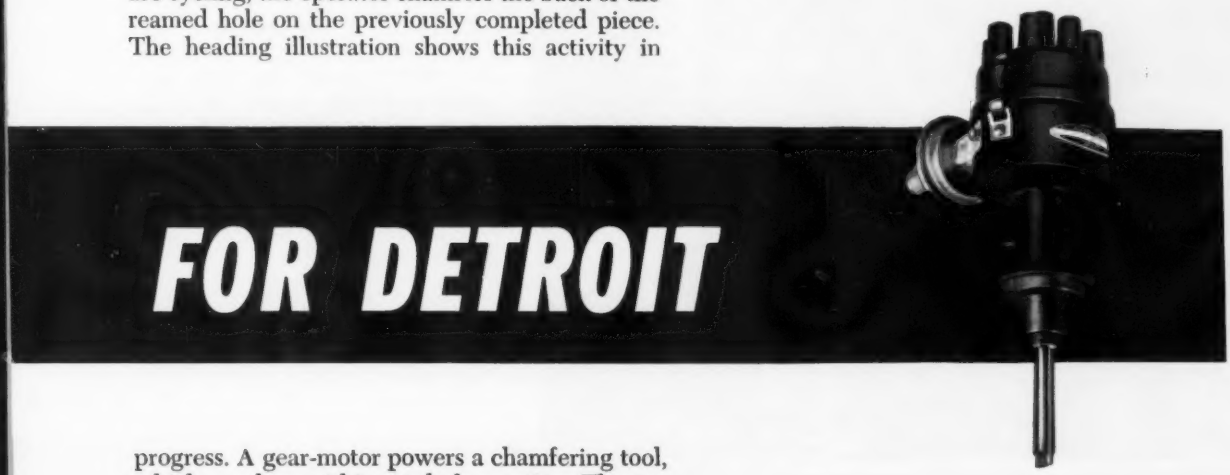


Fig. 1. Distributors with extra-long stems are processed on these machines. The stem is gun-drilled on the boring machine (right), then tracer-turned on the lathe (left).

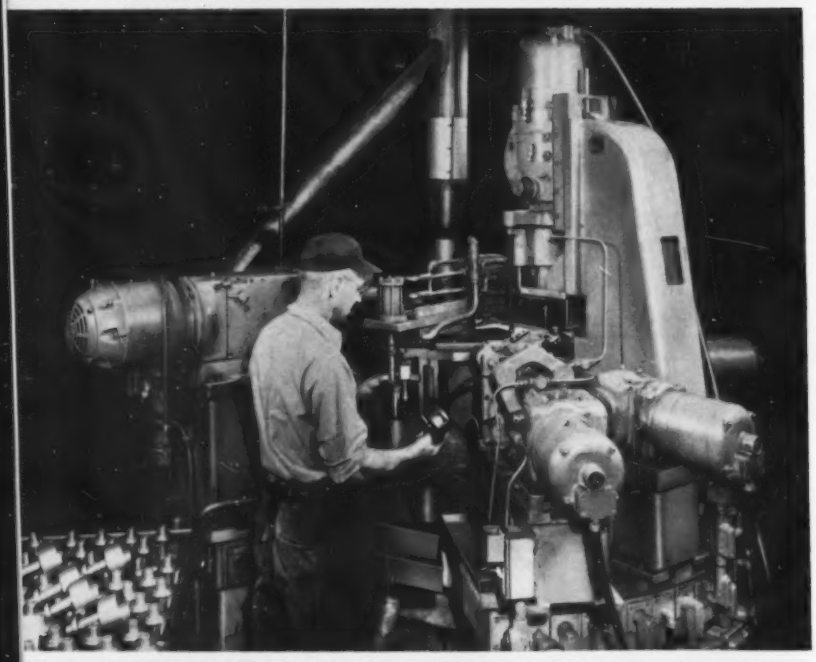


Fig. 2. All of the secondary operations on the bell are completed on dial type machines. Milling of the vacuum-chamber slot takes longest, controls cycle time.

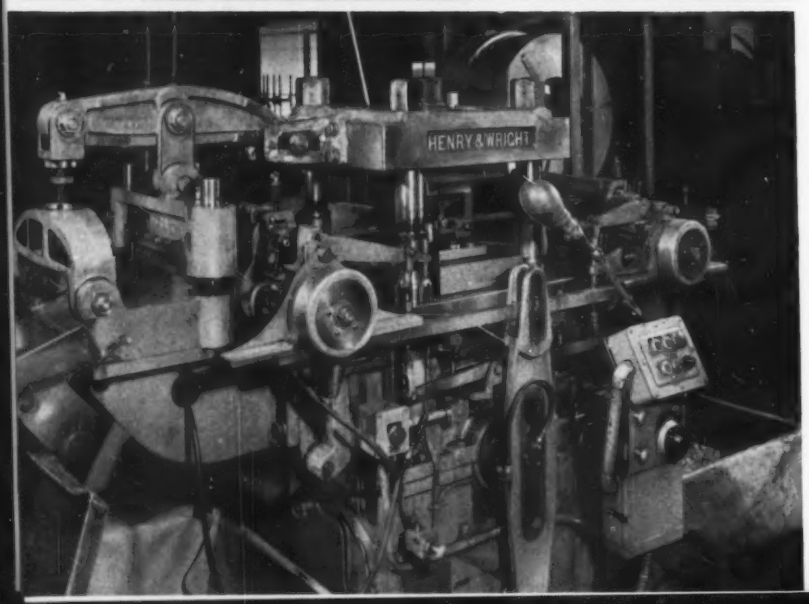


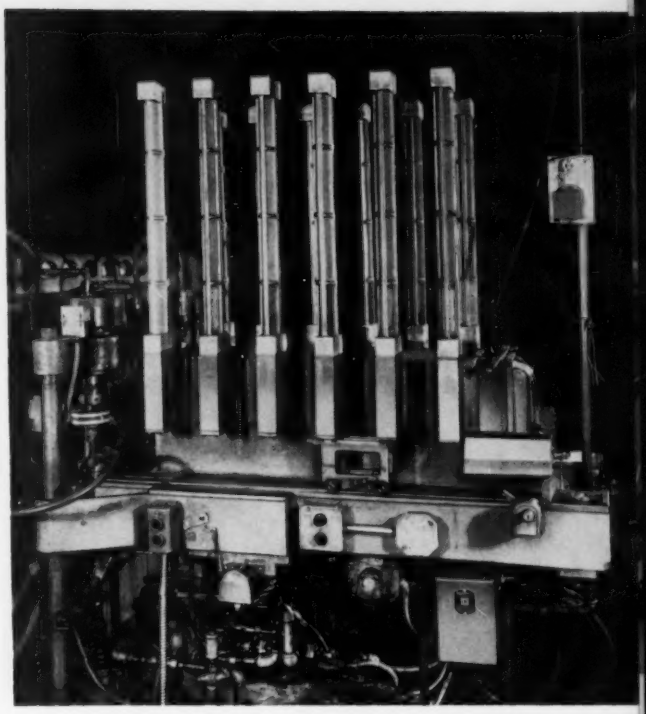
Fig. 3. Governor-weight laminations come off this dieing machine in rapid fire. Three different types of laminations comprise each six-lamination assembly.

toggle clamp through a rack and pinion. When the work has completed its cycle, it goes through a similar series on another dial type machine.

To advance or retard the spark automatically according to engine load and speed changes, the distributor has both a vacuum-chamber assembly and a pair of governor weights. The vacuum-chamber assembly senses decreased or increased engine load and advances or retards the ignition timing accordingly. The governor weights automatically sense engine speed variations and modulate the ignition timing by advancing or retarding the distributor cam assembly as the engine speed increases or decreases.

Each governor weight is of laminated construction, consisting of six small steel stampings, brazed together. These parts are punched and blanked from coil stock on the 60-ton Henry & Wright dieing machine in Fig. 3. Coil stock can be seen feeding to the progressive die of the machine from right to left. To lubricate the strip, it enters through felt rollers which receive a continuous mist of oil.

Since there are three different types of laminations in the governor-weight stack—one, for instance, has a lobe to retain a spring—a large quantity of each type is produced before the dies are changed. The machine averages 286,000 laminations per eight-hour shift, in marked contrast to the 45,000 average of a previous press method.



Trolley Cars Take Laminations to Induction Heaters

After the laminations have been tumble-cleaned and electrolytically plated, two ingenious mechanisms developed by Auto-Lite personnel speed their preparation for the brazing. The first of these is an orienting device, assuring that the pieces will all be facing the same way. The equipment also distinguishes between the three types of laminations, sorting and stacking them automatically in long trays.

Filled trays are then transferred to the second mechanism, illustrated in Fig. 4. The purpose of this equipment is to assemble the six laminations and present them to the brazing equipment. Two rows of six trays each, in proper sequence, are

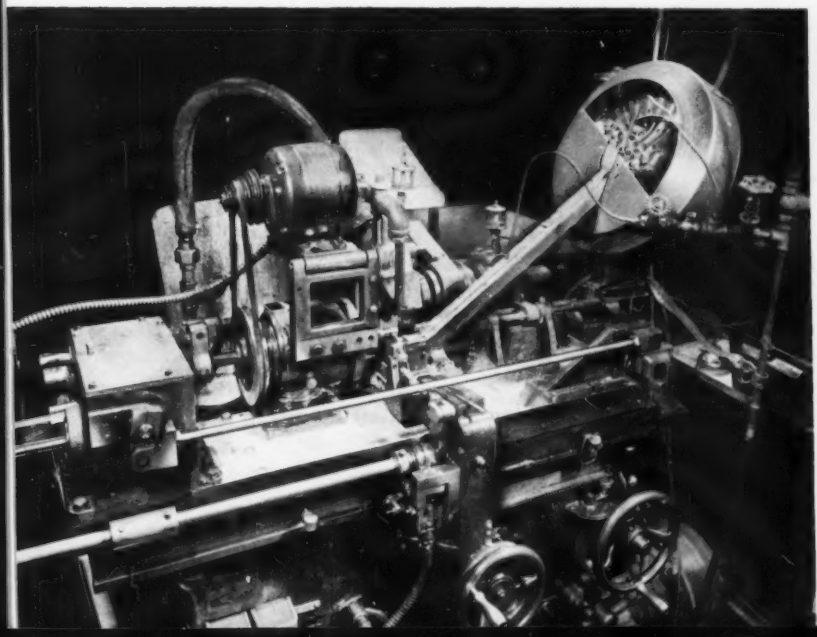


Fig. 4. (Above) The trolley car is seen collecting the lowermost lamination from the third tray. When the car reaches the induction heater at the left, the assembly will be brazed automatically.

Fig. 5. (Left) "Home-made" automation of this grinder completely eliminates manual handling of the bushings from the hopper to the discharge chute.

arranged vertically along opposite sides of a table. Beneath each row, a small trolley car rides on a track from one end of the table to the other. When the car passes under each stack, it collects the lowermost lamination, retaining it in a nest in the car roof.

After all six laminations have been received, the trolley car moves on to a Tocco induction-heating unit next to one end of the table, locating the nest between the electrodes. Brazing is done automatically, after which the assembly is discharged into a chute and the trolley car shuttles back to its starting position at the other end of the table.

Each row has its own welding head. In operation, the two trolley cars alternate, one collecting its laminations while the other is at the induction heater. In subsequent operations, the assembly is shot-blasted, a pin is spun in, and the assembly is cadmium plated.

Two old, but serviceable, grinding machines were fitted nicely into the high-production picture when a resourceful company machinist automated the material handling. One of them is shown in Fig. 5. The equipment grinds the outside diameter on an Oilite bushing to improve its concentricity with the bore. The bushings are used as shaft bearings in the distributor stem.

Loaded in a revolving hopper, the bushings move down a chute until they are directly in front of the grinding area. The part is then automatically picked up by a quill supported from a tailstock. Next, the quill moves to the left, transferring the part to the work-spindle which has advanced to the right. The work-spindle then indexes to the left and the grinding wheel feeds forward and plunge grinds the bushing. After the spark-out, the work-spindle retracts, stripping off the part. The entire automation is set up through cams and linkages with a gear-motor.

Spinning Replaces Crimping in Vacuum-Chamber Assembly

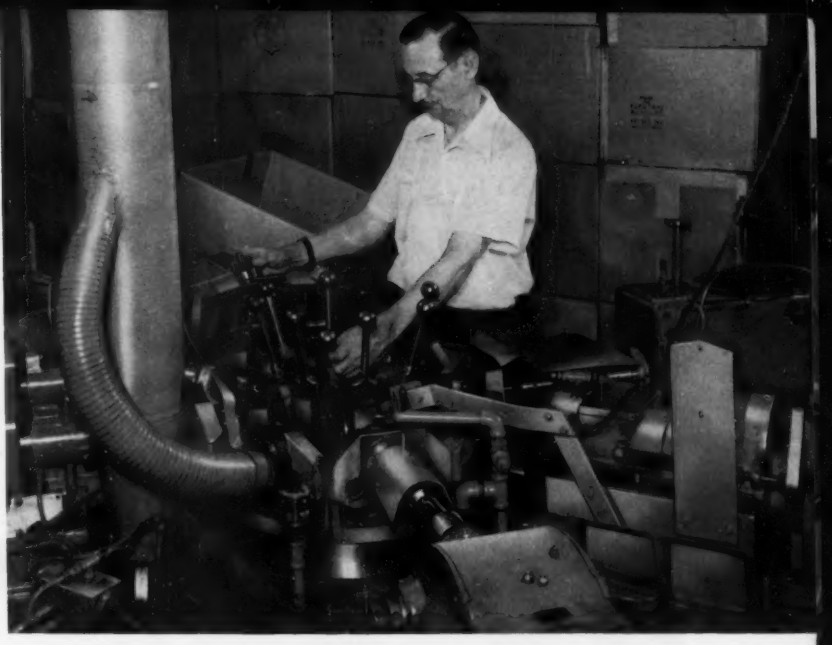
Assembling the distributor's vacuum chamber is sped by a modern version of the old art of metal spinning. The operation, illustrated in Fig. 6, is performed on a Gem machine. As each of the stations of a rotary table reaches the operator, it is filled with the bracket half of the

Fig. 6. (Above) As the machine spindle revolves, three rolls set in the lower face of the spinning head fold the rim of the bracket half of the vacuum chamber.

Fig. 7. (Left) Operator loads the rubbing-block machine with phenolic-impregnated linen strips. Spindles, feeding in opposite directions, drill two small holes following the cut-off operation.

Fig. 8. (Right) This machine produces a rotor diameter step in the inside of the cap. Reverse rotation of the finishing fly cutter minimizes size of burrs.

Fig. 9. (Below) Winding the aluminum foil and kraft paper to make up a "pill" for the distributor's condenser. Operation is performed in an air-conditioned room.



chamber, a diaphragm, and the cover half. Subsequently, the station is indexed by an air cylinder to a position beneath the machine spindle. The spinning head, revolving, then descends. First, a spring-loaded plunger seats the diaphragm. Then three small rolls in the head spin the rim on the bracket half, folding it over the cover. Previously, the assembly was completed in a much slower crimping operation.

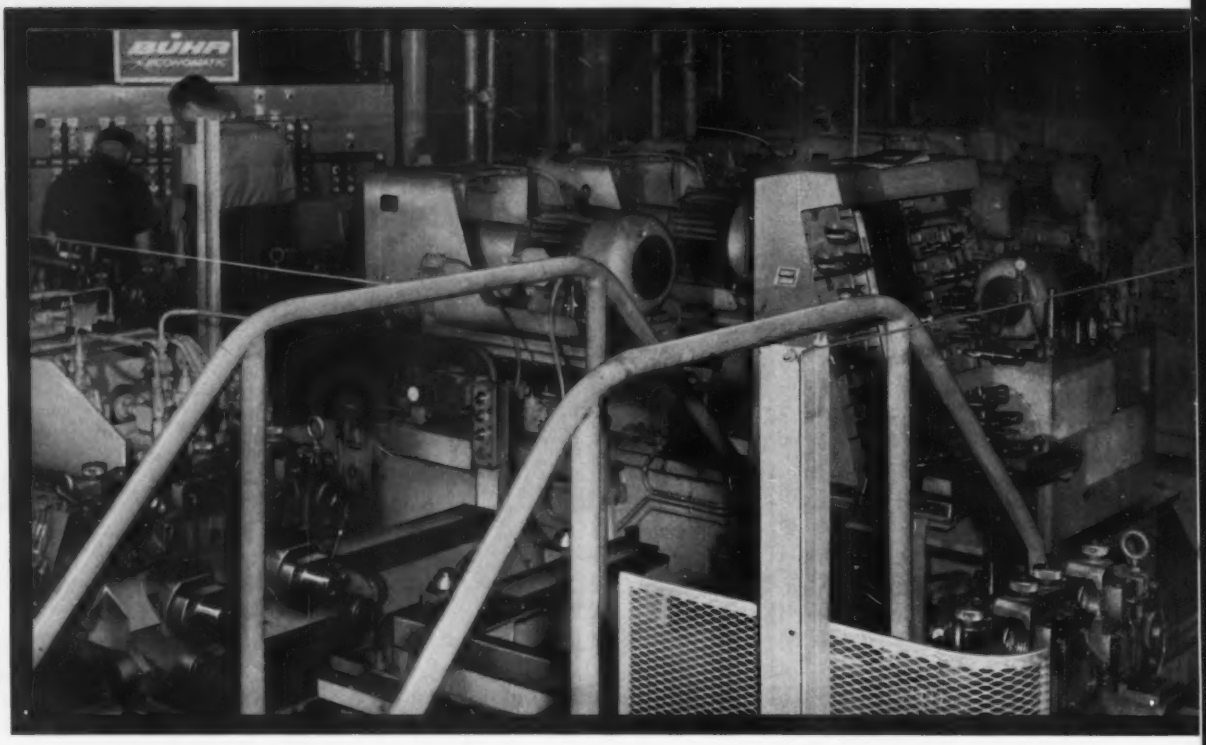
Rubbing-block production is another activity that has been expedited by company-designed equipment, seen in Fig. 7. The blocks are small right-angle pieces of phenolic-impregnated linen which ride against the cam lobes of the distributor.

Strips of the molded material are fed automatically into the machine. After individual blocks have been chopped off by a guillotine knife, they are indexed to position between two opposed drilling spindles. Two 1/16-inch holes are drilled simultaneously. The drills, running at 5000 rpm, are air-fed, and are arranged oppositely because of the close center distance of the holes. Drilled, the rubbing blocks are ejected into the tray seen in front of the machine.

Distributor caps are molded with integral tower inserts of brass or aluminum. The rotor diameter on the inside of the cap is formed by boring a step on the bottoms of the inserts. Fig. 8 shows one of the special Kingsbury machines which perform this operation.

The dial type equipment has eight stations, each set up with a quick-acting fixture. At the work-spindles, the rotor is first rough-bored with a fly cutter. The finish-boring is performed with another fly cutter which rotates in a direction opposite to that of the roughing cutter. In this way, the burr left on each insert is kept to a minimum. At another work station, a steel-wire tool removes the burrs.

In an air-conditioned room, a battery of Kroessler machines wind the "pills" of the distributor's condenser. A close-up view of one of the winders appears in Fig. 9. Each pill is made up of two layers of 0.0002-inch thick aluminum foil separated and insulated by multiple layers of 0.00025-inch thick kraft paper. Both materials are received in rolls of the required width. Two pills are wound simultaneously. The operator is shown applying glue to the outer edge of a wound pill.



A total of fifty-seven operations are performed on each cast-iron pump housing, and two housings are completed per cycle on a versatile transfer machine that features "building-block" construction and facilities for inspecting the parts between stations. Production rates up to 300 housings per hour are possible.

SAFETY power-steering systems made by the Saginaw Steering Gear Division of General Motors Corporation for use on 1959 Cadillac, Buick, Oldsmobile, and Pontiac automobiles feature a submerged type pump which minimizes any possibility of leakage. Component parts of the new pump are encased in an oil reservoir. The reservoir is fastened to the pump housing, leaving only the housing face and shaft hub exposed.

Cast-iron housings for the submerged type pumps are processed on a Buhr Economatic twenty-six-station transfer machine shown in the heading illustration. A total of fifty-seven operations are performed on each housing, including drilling, chamfering, reaming, facing, spot-facing, recessing, boring, and tapping. Since the pallet type work-holding fixtures each carry two housings, the machine actually performs 114 operations simultaneously, and two parts are completed per cycle. The hydraulic-feed transfer machine has a capacity of approximately 300 housings per hour at 100 per cent efficiency or 240 parts at 80 per cent efficiency. Prior to the installation of this unit, the parts were produced on a pilot line that required nine individual multiple-spindle machines.

One feature of the 100-foot-long transfer machine is the extensive use of "building-block" principles in its construction. The bases, heads, hydraulic way units, individual lead-screw tapping units, and other components are standard, self-contained, and interchangeable. This facilitated design, manufacture, and assembly, and provides flexibility for possible future changes in the design of the product. With this arrangement, the Economatic can be lengthened or shortened, and units added or removed, as required. Although this machine has only been in operation for a few months, it has already been modified by providing wire-brush deburring heads at the nineteenth station.

Another feature is the use of integral gaging

TRANSFER MACHINING OF POWER-STEERING PUMP HOUSINGS

CHARLES H. WICK
Managing Editor

pads on each of the forty-two pallet type work-holding fixtures. Gages are stored at various locations along the machine, and a roving inspector periodically places the gages on the fixture pads to check the work-pieces, Fig. 1. This innovation of gaging between successive working stations permits errors to be detected immediately, instead of waiting until the parts have been removed from the transfer machine.

Only two men are required to attend the machine—one to load and unload the pump housings, and the other to change tools when required and inspect the parts in process intermittently. A central control board contains various colored lights which indicate when each machining head has been advanced or retracted, or if any head is not operating. The machine is equipped with forty-one motors having a total of 200 horsepower.

Replacement tools are kept at three conveniently located, Scully-Jones "Toolitrol" stations, one of which is seen in Fig. 2. The sharpened tools are pre-set by means of gages mounted on the Toolitrol boards, so that they can be placed into service immediately. There is no need to reset the tools after they have been mounted on the machine spindles. Dial-indicating counters are provided on these tool control stations to show how many parts have been produced by each tool and when the tools require changing.

Soluble oil is pumped through 300 feet of pipe to the various cutting tools at the rate of 2000 gallons per minute. This cutting fluid washes the cast-iron chips from the work-pieces, fixtures, and machine into an underfloor velocity trench leading to the pit of a central coolant system. The underground pit holds 12,000 gallons. A drag conveyor carries settled out chips to a hopper, and the fluid is pumped through an automatic, pressure type Hydromation filter before being recirculated to the transfer machine. All of the machining heads are oil-mist lubricated by a Norgren Micro-Fog system, and the pallet fixtures are lubricated periodically by a Lincoln drum-pump unit.

Machined pump housings are manually unloaded, and rough castings loaded, at the first station, Fig. 3. Castings are supplied from a storage hopper by means of a vibrating chute. The operator places two castings at a time on the V-block guides of each pallet, and slides the parts into position against fixed pads on one side of each fixture and spring-loaded pads on the other side. Location is by means of four lugs on each casting. Automatic clamping is accomplished by air-motors equipped with stud drivers. The screw-actuated clamps are pivoted to equalize the pressure on the castings.

Fig. 1. Pallet type work-holding fixtures on the transfer machine seen in the heading illustration have built-in pads for gaging parts between stations.

Loaded pallets, each carrying two pump housings, are indexed to the approximate required locations at the various stations on the machine by means of a transfer bar. Then, two hydraulically actuated locating pins are raised into bushings in each pallet for final positioning. Simultaneously, limit switches are tripped to operate four hydraulic clamps which secure the pallet to the machine ways during machining. Limit switches are also provided to prevent the heads from being fed until the pallets are clamped, or the pallets from being indexed until the heads return, the locating pins retract, and the clamps raise.

The total cycle time for completing two pump housings is twenty-four seconds, consisting of: four and five-tenths seconds for transferring the pallets from station to station, one second for final locating, one second for clamping, two seconds for rapid advance of the heads, eleven and five-tenths seconds for machining (this is a maximum, some of the operations requiring less time), one second for dwell, two seconds for rapid return of the heads, and one second for unclamping. Manual loading and unloading of the work-pieces is accomplished during the machining cycle.

Stations 2, 5, 8, 11, 14, 17, 20, and 23 on the transfer machine are idle, and have been provided to accommodate tooling that might be required for possible future changes in the pump-housing design. At the third station, two right-hand heads are tooled to rough-bore two internal surfaces (2.837 and 2.900 inches in diameter) and spot-face (1.312 inch in diameter) another surface in each housing. The tungsten-carbide-tipped tools are rotated at 300 surface feet per minute (397 rpm) and fed at the rate of 0.036

Fig. 2. Sharpened tools are pre-set by means of gages and stored on this tool control board. Dial-indicating counters show when tools require changing.

Fig. 3. Two pump-housing castings are loaded at a time in each pallet. The parts are automatically clamped by air-motors equipped with stud drivers.

inch per revolution for these operations. Similar tooling is provided on the right-hand heads at Station 4 to rough-bore and chamfer a surface 2.723 inches in diameter and core-drill a hole 0.740 inch in diameter. An over-all view of these two stations is shown in Fig. 4.

Generating heads are mounted on the right-hand side of the machine at the sixth station for rough-facing an internal surface in each housing. These single-slide way units have 30-degree cams and are actuated by two hydraulic cylinders. One cylinder advances and retracts the head, while the other—its piston-rod extending through a draw-bar—feeds the tools across the surface. The heads carry quills equipped with triangular tool bits for rough-facing two surfaces in each housing. These tools are also rotated at 300 surface feet per minute (440 rpm) and fed at the rate of 0.0096 inch per revolution. Two heads are also provided on the left-hand side of the machine at the same station for rough-boring and chamfering a hole 1.325 inches in diameter.

Multiple-spindle drill heads are provided on both the left- and right-hand sides of the transfer machine at Station 7 for drilling nine holes. One of the tools on each left-hand head is a four-flute tungsten-carbide-tipped core-drill, 13/16 inch in diameter, which is rotated at 120 surface feet per minute (564 rpm), and fed to a depth of 3/8 inch at the rate of 0.0098 inch per minute. Dual heads on both sides at the ninth station are tooled to spot-face two mounting lugs and drill five holes. Four more holes are drilled at Station 10, and three of the holes that were previously drilled (and that are to be tapped subsequently) are probed.

Two O-ring grooves, approximately 3 3/32 inch in diameter by 1/8 inch wide, are rough-recessed, and a snap-ring groove about the same size is finish-recessed by tooling mounted on the right-hand heads at the twelfth station. Special, generating type grooving heads having single slides, 20-degree cams, and three-blade, tungsten-carbide-tipped, circular form cutters are used for these operations. These tools are rotated at 225

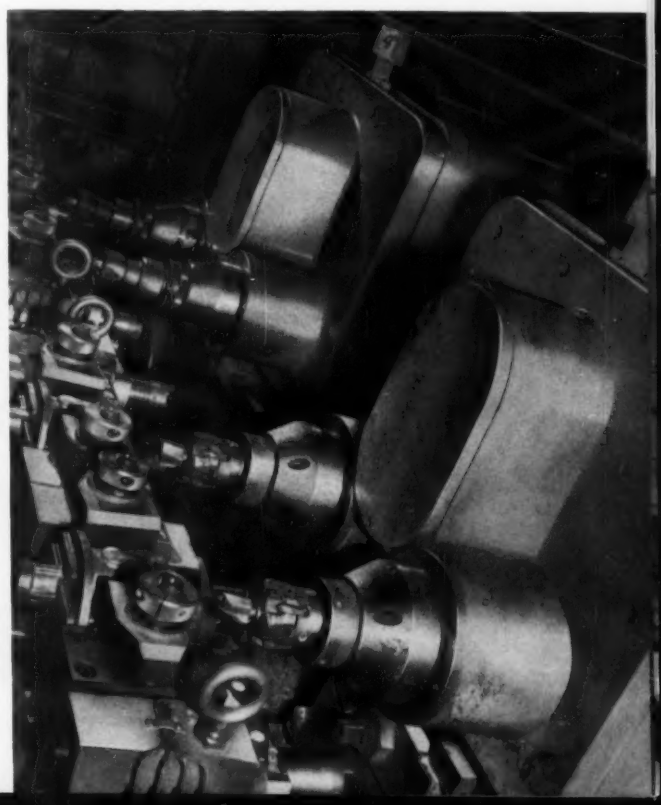


Fig. 4. At the third (foreground) and fourth (rear) stations, pump housings are rough-bored, spot-faced, and chamfered with tungsten-carbide-tipped tools.

Fig. 5. Generating type grooving heads are provided at the fifteenth station of the transfer machine. Two O-ring grooves are finish-recessed in the bore of each cast-iron pump housing.

surface feet per minute (279 rpm), and fed at the rate of 0.0028 inch per revolution. A hole 0.843 inch in diameter by 1 5/8 inches deep is rough-reamed in each pump housing by six-blade, tungsten-carbide-tipped reamers mounted on the left-hand heads at this station.

On the two right-hand heads at Station 13, probes are provided to check and "blow-out" four holes. An innovation in this setup is the use of the soluble-oil cutting fluid for blow-out instead of air conventionally employed. The left-hand heads are tooled to semifinish-bore and counterbore another hole in each housing. The two O-ring grooves are finish-recessed at the fifteenth station, Fig. 5, by generating type grooving heads.

Finish-boring of three internal surfaces in each pump housing is performed at Station 16, using inserted blade, tungsten-carbide-tipped boring tools. A hole 0.770 inch in diameter is also reamed at the same station. Two more bores are finished, and another surface is finish-faced at the eighteenth station, to a depth tolerance of plus or minus 0.0015 inch.

When the transfer machine was first installed, it was necessary to deburr the three grooves in the large bores in each pump housing in a subsequent operation. Now, this is done on the machine by means of two special heads at the right-hand side of Station 19. These gear-driven heads have belt-driven spindles (rotating at 3600 rpm), and planetary quills rotated by hydraulic motors. The quills hold special, dynamically balanced arbors that rotate at 7140 rpm and carry wire de-

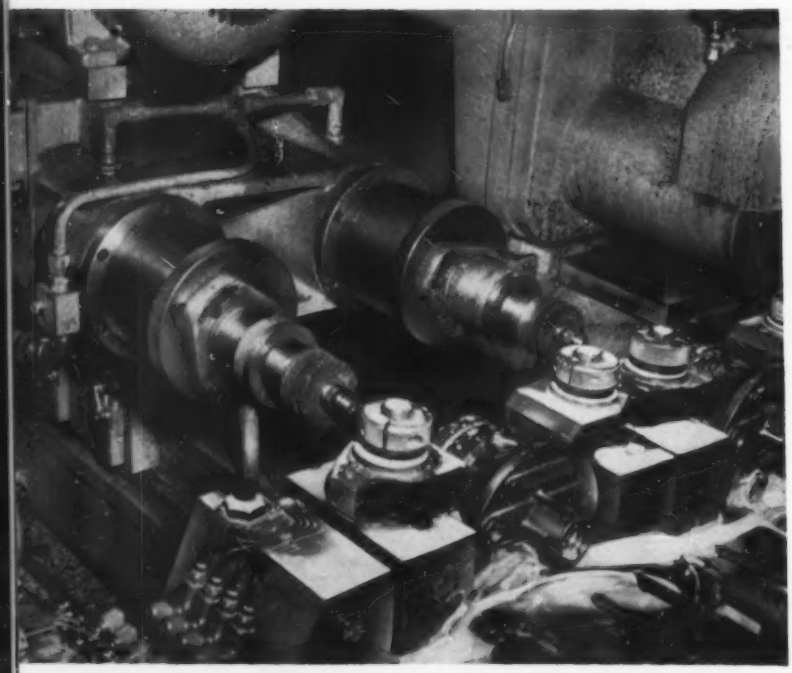


Fig. 6. Deburring of three grooves in the large bores is done with rubber-bonded wire brushes mounted on the right-hand heads at the nineteenth station. The brushes rotate at 7140 rpm.

burring brushes, 2 1/2 inches in diameter, Fig. 6. The Osborn brushes are made up of 0.0118-inch diameter, rubber-bonded wire, and they are discarded when their outside diameters are reduced to 1 5/8 inches. When new, the brushes operate at a surface speed of 4672 feet per minute, and, just before discarding, at 3037 feet per minute.

Heads on the left-hand side of Station 19 carry floating holders and four-flute, high-speed steel taps for producing three 3/8-16 thread holes in each housing. Four holes are reamed, and the three tapped holes are probed at the twenty-first station. Stellite-tipped form cutters are provided at Station 22 to form and chamfer recess grooves 0.790 inch in diameter by 0.041 inch wide. Another hole in each part is finish-reamed at the same station.

Two holes are tapped (3/8-16 threads) at Station 24, and these holes are probed and another hole reamed at the twenty-fifth station, Fig. 7. At Station 26, the pallets are automatically shuttled at right angles to the direction in which they have been transferred, until they reach a parallel chain conveyor, Fig. 8.

On this return conveyor, the loaded pallets pass through a two-stage washer and air blow-off unit. At the end of the parallel return conveyor, the parts are again shuttled at right angles to return them to the unloading and reloading station.

A pallet inspection station, Fig. 9, is provided on this cross-over shuttle conveyor. Here, two pallets can be stored on one side of the conveyor,

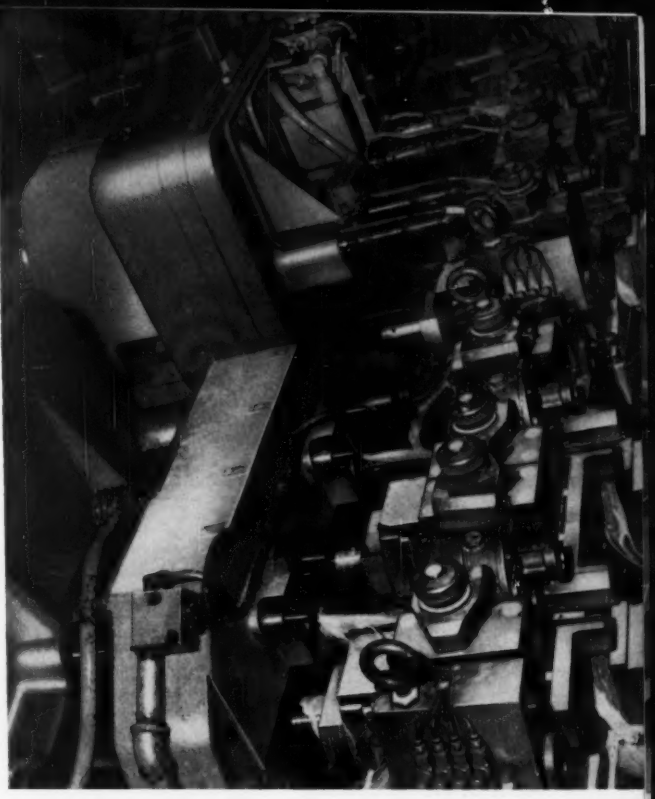


Fig. 7. At Station 24 (top), two holes are tapped in each casting. When the pallet has been indexed to the twenty-fifth station (bottom), the tapped holes are probed and another hole is reamed.

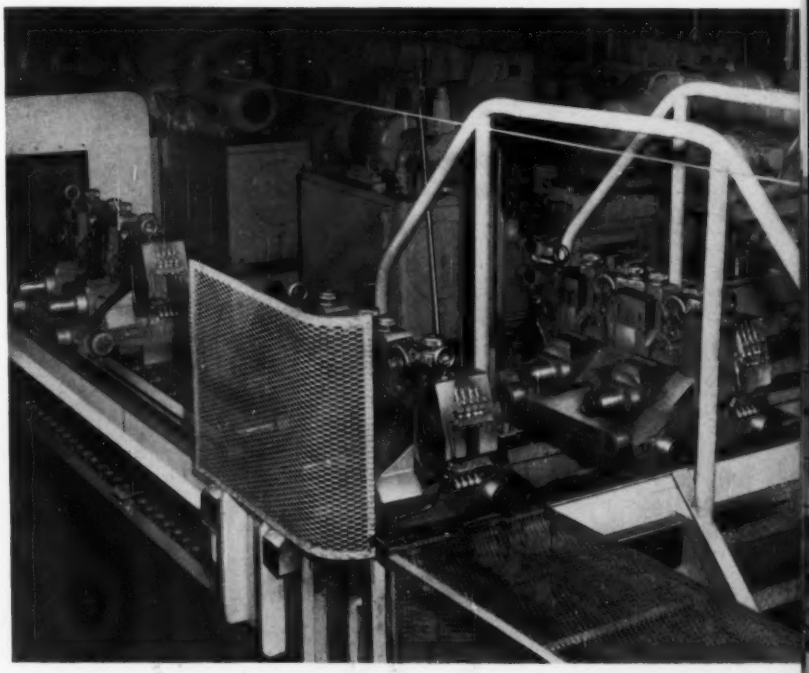


Fig. 8. In returning to the loading station, the loaded pallets pass through a two-stage washing machine (left) where they are cleaned by coolant jets and blown off by air blasts.

and a third checked on the opposite side. Suitable gages are used to inspect each pallet periodically or whenever trouble is encountered in maintaining the specified tolerances.

As the operator unloads the pallets, he places the pump housings in collet chucks on a Bullard twelve-spindle Contin-U-Matic machine, where the hub ends of the castings are faced. Then, the housings are processed on four rotary indexing machines. On the first, a Buhr nine-station machine, three holes are drilled and one reamed. One of the holes, 11/64 inch in diameter by 1.147 inches deep, is completed in three successive steps. Two multiple-diameter holes are drilled, spot-faced, counterbored, and reamed, and one of the holes is tapped on the second machine—a Kingsbury nine-station automatic. Then, an Avey four-station machine is used to drill three holes. Finally, an Allen four-station machine is employed to drill, counterbore, and ream one multiple-diameter hole, and drill another hole 1/8 inch in diameter (Fig. 10).

A babbitt bushing is pressed into the bore of each pump housing on a Denison press. An external groove, 5.163 inches in diameter by 0.178 inch wide, is then cut into the casting peripheries on a National Acme eight-spindle, double-indexing chucking machine.

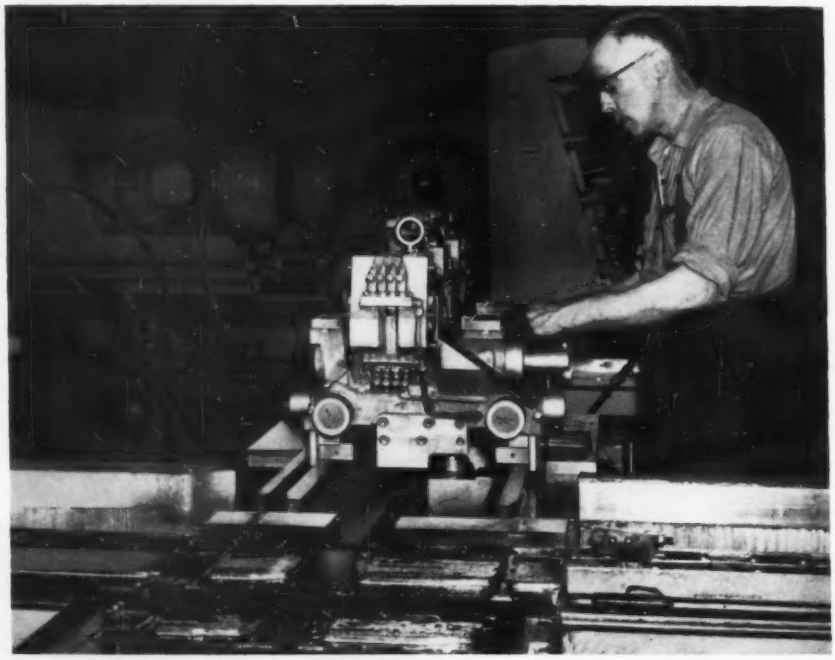


Fig. 9. (Right) The pallet type work-holding fixtures are periodically pushed off the cross-over shuttle conveyor (foreground) and inspected by means of suitable gages.

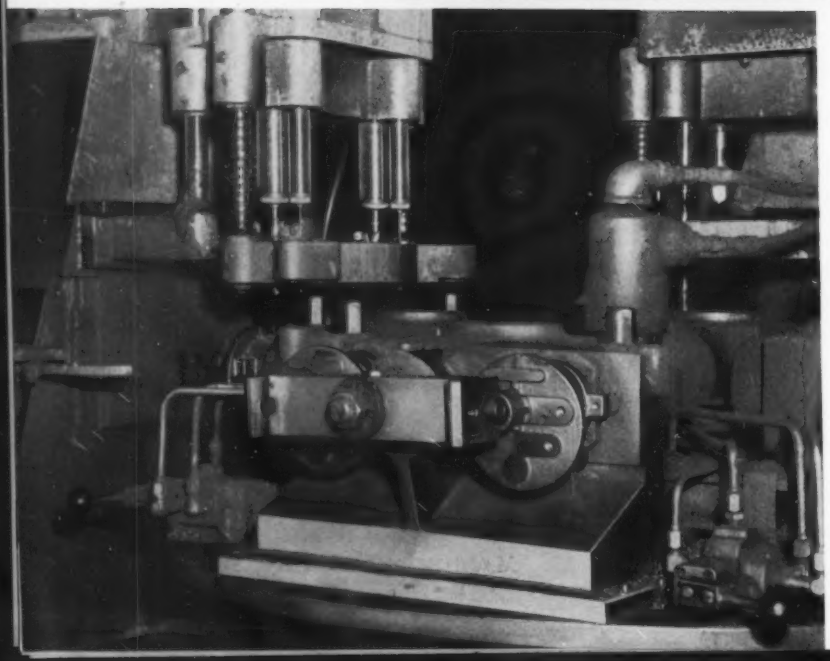


Fig. 10. (Left) Two holes are drilled in each pump housing on this four-station, dial type machine having vertical heads. One of the holes is also counterbored and reamed.

Plunger holes in the pump housings are finish-bored to a diameter between 0.6670 and 0.6675 on an Ex-Cell-O double-spindle machine, Fig. 11. The tools are rotated at 2500 rpm, and the carbide tools are fed at the rate of 0.0014 inch per revolution for this operation. While a tolerance of 0.0005 inch is permitted, size is consistently held within 0.0003 inch. "Ballizing" of the plunger-hole bore is then accomplished by clamping the pump housing to the bed-plate of a Denison 10-ton, air-hydraulic press, Fig. 12, and pushing a carbide ball (fastened to the end of the press ram) through the bore. This operation increases the diameter of the plunger-hole bore approximately 0.0005 inch (to between 0.6675 and 0.6680 inch) and produces a surface finish of 32 micro-inches or less.

Finally, the babbitt bushing is finish-bored to a diameter between 0.7508 and 0.7513 inch, and the oil-seal bore is finished to a diameter between 1.311 and 1.312 inches, on an Ex-Cell-O precision boring machine. These surfaces must be concentric with each other and with another bore in the housing within 0.003-inch total indicator reading, and square with the housing face within 0.001-inch total indicator reading. After washing and final inspection, the pump housings are ready for assembly.

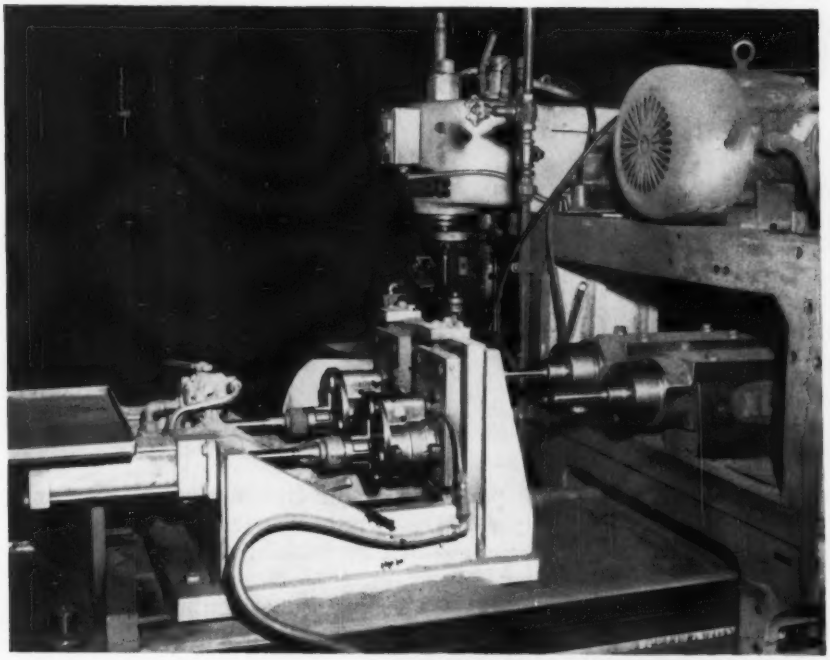


Fig. 11. (Left) Double-spindle machine for finish-boring the plunger holes in the pump housings, two at a time, to a diameter between 0.6670 and 0.6675 inch.

Fig. 12. (Right) "Ballizing" of plunger-hole bore is accomplished with a carbide ball fastened to end of press ram. Work-piece is clamped to bed-plate during operation.

MACK HAS A KNACK for

HAROLD W. BREDIN
Associate Editor

EARLY ADOPTION of advanced manufacturing techniques is a policy profitably followed by Mack Trucks, Inc., Plainfield, N. J. Higher quality parts, faster production rates, and reduced operating costs are some of the benefits obtained. On occasion, new processes make possible the application of materials with properties that improve a part functionally.

Valve lifters for Mack engines are an example. These parts are now being faced with tungsten carbide by a patented process to make them last the life of the vehicle. Economical manufacture of the part is made feasible only by the use of some unique, modern, production and inspection methods. Details of the blank for the unusually wear-resistant component are illustrated in Fig. 1.

Blanks for the valve lifter are purchased by the company cold-headed from steel wire. The initial machining is the center-drilling of each end of the blanks in a Kingsbury centering machine. Following this, the parts are loaded into a New Britain-Gridley multiple-spindle chucking machine where turning, facing, and several drilling operations are performed.

The periphery of the head of the valve lifter is finish-turned in a Heald Bore-Matic precision boring machine, and at the same time a hole in the face is counterbored. At this stage of production, the work-pieces are washed in a degreasing solution. The parts are then sent to a Blanchard rotary surface grinding machine where the face of the blank is ground to the proper thickness. A belt sander is used to remove the burr that is raised in the grinding operation.

Next, a steel shroud is assembled over the edge of the valve-lifter head and a tungsten-carbide facing disc of the same diameter placed under it. All parts except the tungsten-carbide disc are vapor degreased prior to brazing. The valve-lifter assemblies are then loaded head down in racks of sixty, placed in a Lindberg furnace (heading illustration), and brazed. With the present setup, valve lifters are brazed at the rate of 900 per day.

In brazing, excess copper is deposited on the outer face of the tungsten-carbide disc, on the outside of the shroud, and on exposed portions of the body. This copper is removed chemically by submerging the assembly in a tank containing a solution of sodium cyanide for five hours.

Rough- and finish-machining of the spherical cup-seat in the end of the valve lifter is accomplished on a Warner & Swasey ram type turret lathe. Tool marks left in the seat are removed by polishing. The shank of the work-piece is then semifinish-ground in a Cincinnati centerless grinding machine.

Both the shank and the cup-seat are heated in Tocco induction hardening equipment and quenched in oil. The hardness of the surface of the shank after finish-grinding is required to be in the range of from 30 to 55 Rockwell C. A hardness of from 45 to 55 Rockwell C is specified

for the surface of the cup. After hardening, the cup-seat is again polished. Finish-grinding of the shank is accomplished in another Cincinnati centerless grinding machine, a surface finish of 16 micro-inches being produced.

The parts are then transferred to a Hammond oscillating type carbide tool grinder (Fig. 2) set up for electrolytic grinding of the tungsten-carbide face. An Anocut electronic control unit supplies direct current at 7 volts for the operation. Although the cycle of the grinder is automatic, the work-pieces are hand-loaded, two at a time, into carbide-faced V-blocks and secured in place by quick-acting, lever-operated clamps. The special wheel used has a working surface of diamond grit held in a metallic binder.

In operation, a flow of electrolyte is passed between the work and the wheel, which is an electrical conductor. As the current flows from the work to the wheel, tungsten carbide is removed electrolytically from the face of the work-piece. However, the material removed is carried away by the electrolyte and is not deposited on the wheel. The side of the wheel which is used for the grinding is recessed at the center. Two work-pieces are simultaneously processed, each being oscillated past one side of the remaining annular surface of the wheel. Contact between the work and the abrasive particles in the wheel allows accurate dimensional control. A current of 200 amperes is used for roughing, while finishing is done at 300 amperes.

The entire operating cycle of the machine is completed in seventy seconds. Tolerance on flatness of the valve-lifter face is 0.0005 inch, only a crowned surface being permitted. In addition, the face must be square with the shank within 0.0015 inch, total indicator reading at the edge. A surface finish having a maximum roughness of 5 micro-inches is obtained. The tungsten-carbide disc has a hardness of 88 to 89 Rockwell A.

At inspection, the valve lifter is first treated with Zyglo fluorescent penetrant and visually checked under black light for cracks and other faults. Improper brazing is discovered by Magnaflux Sonizon ultrasonic, resonant-frequency test equipment (Fig. 3). This device is basically a thickness gage. The horizontal sweep beam on the instrument's cathode-ray tube deflects vertically when the thickness of the material under a search probe causes the ultrasonic vibrations emitted from the probe to resonate. In this case, the probe is set to emit vibrations that resonate at thicknesses of from 0.035 to 0.070 inch. This measuring range straddles the thickness zone occupied by the brazed joint holding the disc to the body when the probe is placed on the face of the tungsten-carbide disc. Should the brazing be imperfect, the resulting discontinuity of material will cause a vertical deflection of the

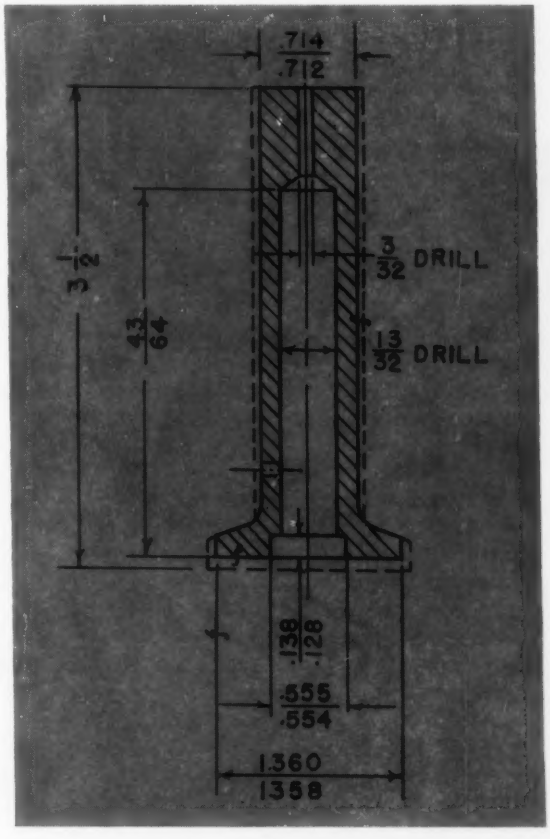


Fig. 1. Valve-lifter body is machined from a cold-headed blank, shown in dotted outline. Dimensions are those prior to assembly with a facing of tungsten carbide.

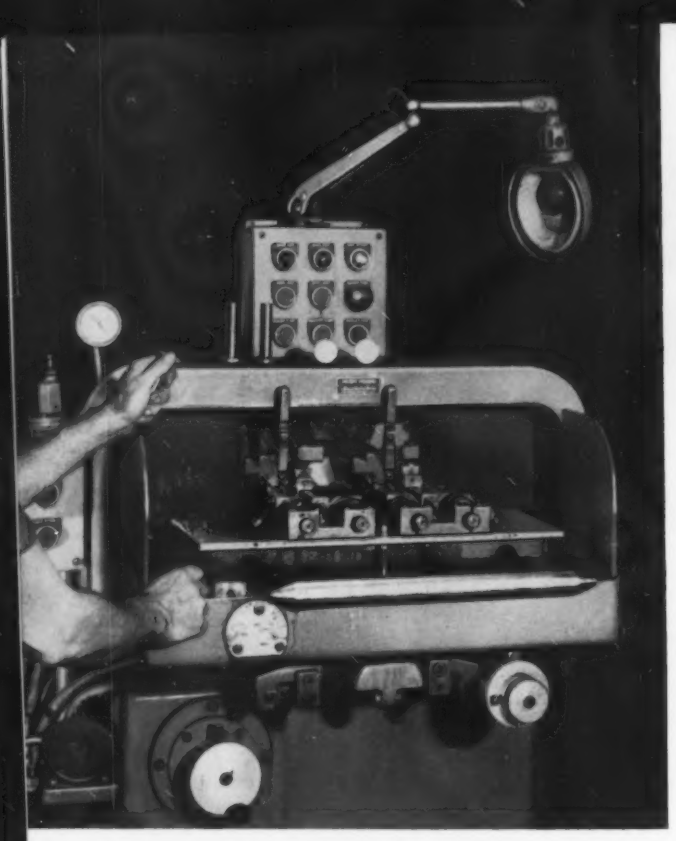


Fig. 2. Tungsten-carbide face of the valve lifter is finished by electrolytic grinding in this machine, two parts at a time. An electronic control unit supplies current for the operation.

otherwise continuous, horizontal beam visible on the cathode-ray tube.

Another example of a recently developed method used by the company is the application of machine-finishing to hardened gears. In the process, an abrasive, gear-shaped tool made of silicon carbide bonded in plastic is rotated in mesh with hardened gears. This action removes nicks and burrs to improve the finish of the gears, and results in their quiet operation. The equipment used is an abrasive, hard-gear finishing machine (Fig. 4) made by Michigan Tool Co.

In operation, a hardened gear is mounted on an arbor while the machine is finishing the previous gear. After the machine is unloaded, the arbor is mounted on the one fixed center and the other center, pneumatically operated, is moved into place. The machine table then slowly reciprocates, traversing the gear across the tool for the full width of the gear, as both tool and gear rotate in mesh. To obtain a good finishing action, the tool axis is set at an angle of about 25 degrees with that of the gear. During the operating cycle, which is automatic, the gear is rotated in both directions, and constant pressure is maintained between the tool and the work. The coolant used, Shear-Speed No. 50, also keeps both work and tool clean. A second gear for a truck transmission is seen set up for finishing in Fig. 4. To complete the operation, the tool is rotated at 300 rpm in mesh with the gear for one hundred seconds. Formerly lapped by hand for one-half hour, these gears were seldom as quiet in operation as those now being finished by machine. The company expects that an average of 1000 gears can be finished with a single tool.

Gears and many other components produced by the company are casehardened by gas carburizing in a Surface Combustion automatic, pusher type furnace. In Fig. 5, a rack containing transmission gears is seen being loaded into the hooded charging vestibule of this continuous gas-carburizing equipment. After passing through the five zones of the furnace, the gears emerge from a hooded discharge vestibule and are quenched. Bull gears and bevel gears are quenched in a Gleason quenching press, such as the one seen in Fig. 6. This press prevents distortion during quenching by holding the gear under pressure between two dies and expanding an assembly of segments within the bore. The parts are then conveyed through a washing machine and into a tempering furnace.

Fig. 3. Ultrasonic inspection equipment of the resonant-frequency type is used to detect imperfect brazing. Probe is passed over face of work-piece and braze condition is indicated on cathode-ray tube.

Fig. 4. Here, a casehardened second gear for a truck transmission is being processed in an abrasive, hard-gear finishing machine. Gear-shaped tool (rear) is made of silicon carbide bonded in plastic.

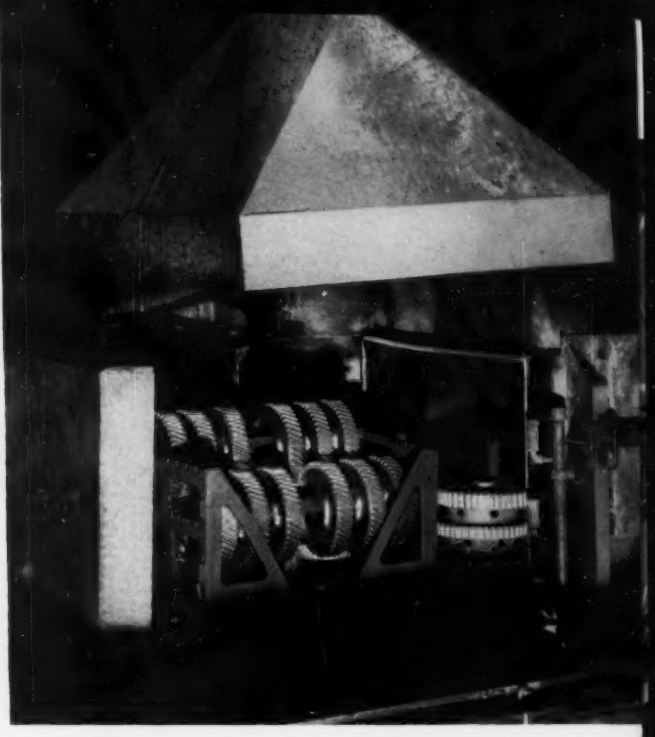


Fig. 5. These transmission gears are being pushed into charging vestibule of a continuous gas-carburizing furnace. In nine and one-half hours the gears reach the end of the furnace and are quenched.

The atmosphere in the carburizing furnace is natural gas catalytically cracked in special gas generators. In addition, natural gas is burned in radiant tubes to heat the furnace. Control of the surface carbon content of the carburized parts is accomplished by maintaining the gas atmosphere at the proper dew point. Enriching gas, which is also cracked natural gas, is added to the various zones as it is required to obtain the desired dew point. A recently developed method allows the company to control the surface carbon content of carburized parts to within a few hundredths of a per cent. This accurate control is made possible by the addition of small amounts of air to the atmosphere near discharge end of the furnace.

A loss of about fifteen hours of operating time for starting and stopping the furnace because of week-end closing of the plant has been eliminated by a process known as "suspended carburization." This method allows the parts to be left in the furnace over the week-end. Gas flow through the furnace is increased 300 cubic feet per hour (maintaining a pressure of 0.2 inch of water), the temperature is dropped to 1325 degrees F., and the dew point of the atmosphere gas is raised to 55 degrees F. These furnace conditions create a state of equilibrium between the part and the gas to effectively suspend the carburizing process. Starting the furnace is accomplished simply by readjusting the furnace to normal operating conditions.

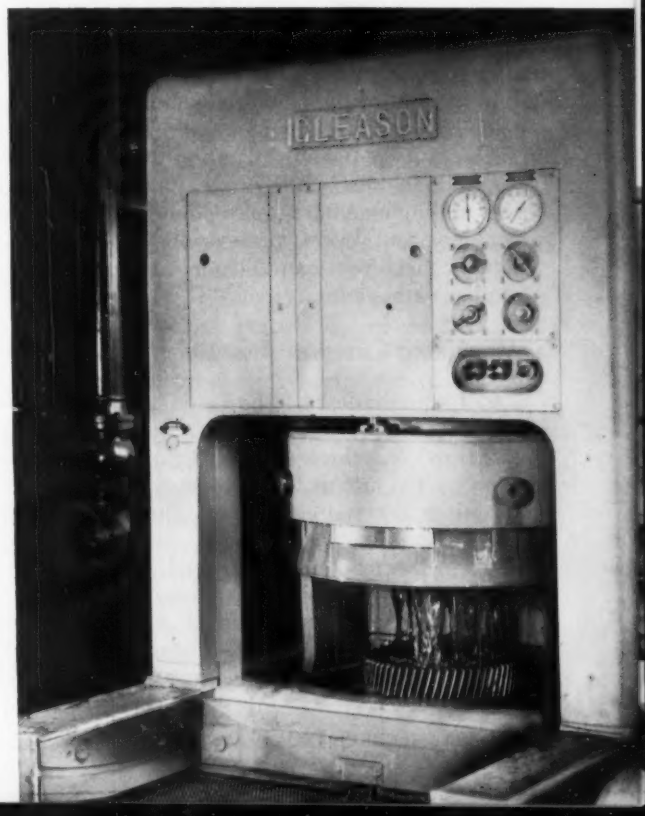


Fig. 6. Here, distortion of a helical bull gear is prevented by a quenching press. The part is held under pressure between two dies, and an assembly of segments is expanded within the bore.

SMALL CARS PRODUCED IN A BIG WAY

Mass-production methods are speeding the manufacture of English automobiles. Among the equipment being employed in one plant are special-purpose machines, contouring machines, and transfer machines incorporating the latest design and operating features.

A TOUR through the passenger-car production facilities of Vauxhall Motors, Ltd., in Luton, Bedfordshire, England, would reveal a sight not unfamiliar to those acquainted with American manufacturing methods. A major plant revision has recently been completed to handle production of the new "Victor"—a four-door sedan that has been designed to accommodate four passengers comfortably.

In setting up the new lines some 3000 existing machines were relocated and more than 2000 new machines were installed. Among these—precision boring machines, both duplex and special-purpose milling machines, unique multiple-operation machines, and several large, up-to-date automatic transfer machines—can be found many that bear familiar nameplates.

Machining Cast-Iron Transmission Housings

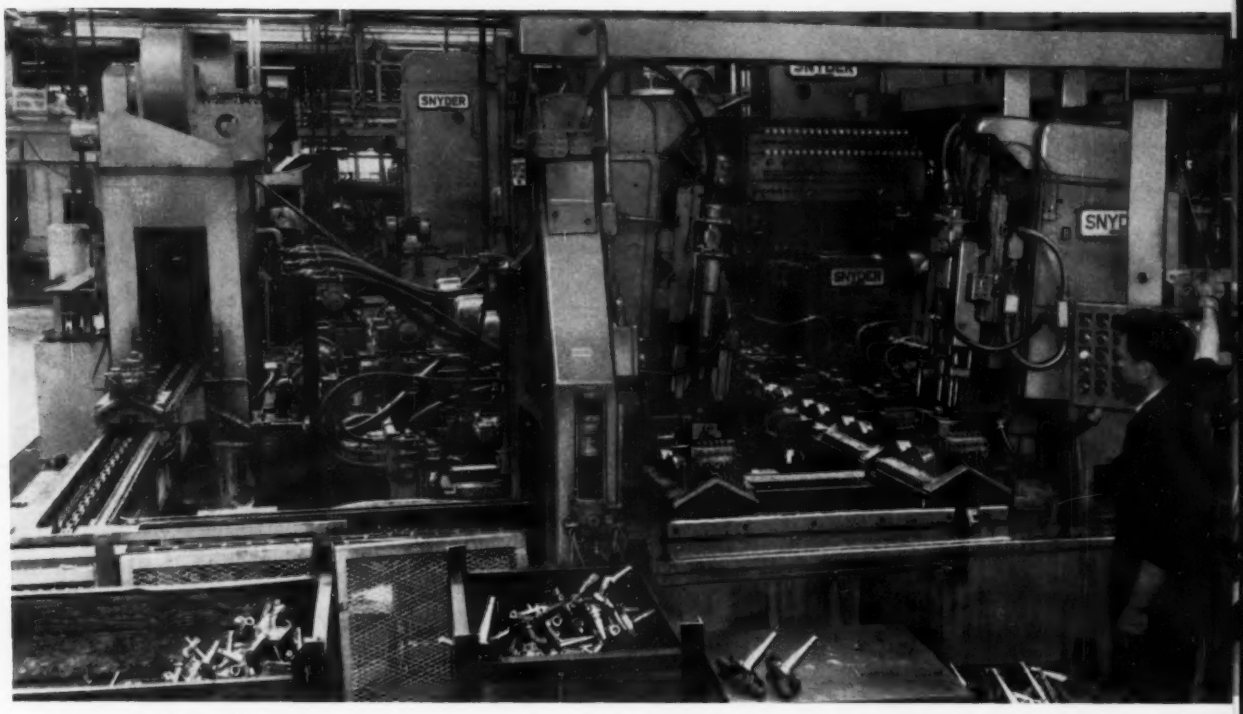
A four-cylinder, 48-hp engine drives the Victor through a standard synchromesh transmission, providing three speeds forward and one in reverse. To minimize transmission noise, the housing is a gray-iron casting. Three completed transmission housings, Fig. 1, are oriented to illustrate the machining required.

Before any machining is done, the castings pass through an automatic shot-blasting unit while suspended on hangers from an overhead track conveyor. The castings are rotated slowly as they move along. Sprays of shot are directed from above and below so that all surfaces are equally exposed. Upon exiting from the enclosure, the treated castings are removed from the hangers by hand, placed on an inclined roller conveyor, and moved by gravity to a banking position alongside the first machine in this particular line.

Two Cincinnati machines are employed for preliminary operations on the castings. One machine is used for milling, drilling, and surface broaching, and the other for milling only. An operator can be seen loading one of three fixtures on the indexing table of the first machine, in Fig. 2.

After indexing counterclockwise, the rectangular cover-mounting flange (left, Fig. 1) is rough-milled at the right-hand station by an 8-inch diameter cutter having twenty-eight carbide-tipped inserts. The next indexing movement positions the casting beneath a multiple-spindle drill head at the rear of the machine. Here, twelve holes are drilled—ten are to be subsequently tapped to receive 1/4-20 screws, and two are held to 0.437 plus 0.001 minus 0.000 inch in diameter for locating at a later operation.

During the next indexing movement of the table, the casting is carried under the overhanging machine member at the left and back to the loading position. A six-tooth surface broach is mounted on the underside of this member. As



the casting passes beneath it, each tooth removes approximately 0.001 inch of metal from the flange face, leaving a flat, smooth surface. Table rotation provides a broaching speed of 18 fpm (feet per minute).

End faces of the housings are straddle-milled in two steps on the Cincinnati machine shown in Fig. 3. At the loading station, rear, the casting is clamped hydraulically. The table is then indexed 90 degrees counterclockwise and the end faces are rough-milled by the duplex head at the left. An idle station follows, after which the duplex head at the right finish-mills the same two faces.

All four face-milling cutters are 8 inches in diameter and are fitted with twenty-four carbide-tipped inserted blades. For roughing, a spindle speed of 100 rpm is used with a feed rate of 17 ipm (inches per minute) and a 3/32-inch maximum depth of cut per side. Finishing rates are 125 rpm, 20 ipm, and 0.030 inch. Cycle time of both this machine and the one previously described is forty seconds, an output of about seventy castings per hour.

With the exception of precision boring operations on several critical holes, all remaining work on the transmission housing is done on a Snyder in-line transfer machine. Along the length of this fifty-three-station installation the castings are drilled, reamed, spot-faced, chamfered, bored, tapped, and milled at a rate of eighty per hour.

Parts are delivered to the transfer machine, Fig. 4, along the roller conveyor seen in the foreground. An operator can be seen placing a casting on the loading stage at the left. No pallets are used. At each machining station locating pins enter the two 0.437-inch diameter holes in the rectangular mounting flange.

The machine is made up of thirteen segments with idle stations between them. Each segment is a standard unit. Because of the small size of the castings, most of the machining stations are combined in groups of two and three—each group being served by a single head on either side of the transfer ways. Each segment has combination fixtures to suit the number of machining stations it incorporates.

Various operations carried out on the machine may be divided into three sections based on the position of the casting with relation to the workheads. A reorienting station is located between the first and second sections at which the casting is turned 90 degrees in a horizontal plane. Between the second and third sections a turnover station moves the casting 90 degrees in a vertical plane so that is rests on its front face.

After leaving the transfer machine the housings are washed; then delivered to the Ex-Cell-O precision boring machine shown in Fig. 5. This machine has ten spindles and handles two castings simultaneously. Once again the castings are located by pins that engage the 0.437-inch diameter holes in the rectangular mounting flange.

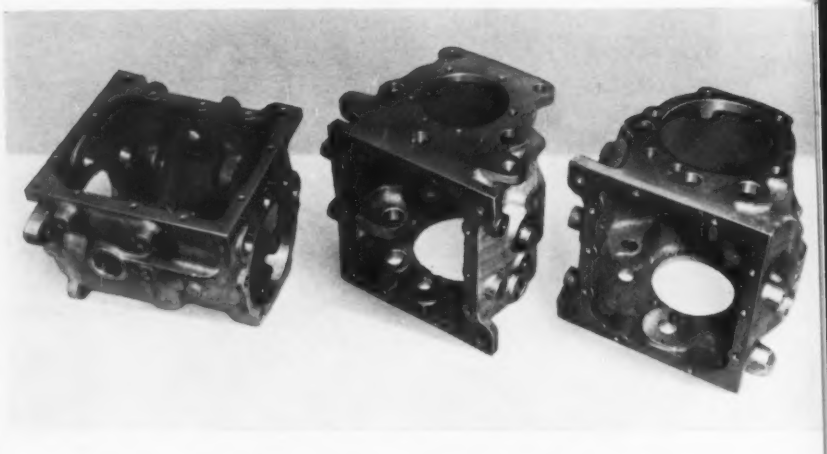


Fig. 1. Three completed transmission housings are positioned to show some of the machined surfaces and holes. Upper exposed surfaces are cover-mounting flange, left; front end face, center; and rear end face, right.

Although automatic unloading equipment has been designed and built for this operation, it has not yet been installed.

Machining the Rear Transmission Extension

As was the case with the transmission housing, the rear extension is also a gray-iron casting. This conical unit is bolted to the rear face of the housing and encloses the main transmission shaft. Before the castings enter the main shop area they are shot-blasted internally and externally on a special, semi-automatic machine.

From the shot-blasting unit the castings pass to a duplex, trunnion type boring, facing, and chamfering machine. A four-station (three active, one loading and unloading) indexing fixture carries the parts past the work-heads. During the machining cycle a shaft clearance hole is finished, two bearing seats are semifinished, and both ends are faced and chamfered internally. Subsequent operations finish these surfaces and drill five bolt holes through the flange—one of which is reamed for locating purposes.

A special C.V.A.-Kearney & Trecker milling machine, Fig. 6, is used to face the area around the five bolt holes at rear of flange. The transmission extension is located on a vertical plug and is positioned by a pin entering the reamed bolt hole. An air cylinder provides the final clamping.

Three work-heads surround the casting. As can be seen in the illustration, the rear head has a single vertical spindle. It drives a 6-inch diameter cutter having eighteen carbide-tipped inserted teeth. Both of the remaining heads are of two-spindle design. All four of these spindles carry 4-inch diameter, twelve-tooth (carbide-tipped) cutters.

A steel bushing lined with white metal is pressed into the finished bore at the small end of the casting. Two castings are then mounted side-by-side on the Ex-Cell-O precision boring machine shown in Fig. 7. During the operation, the right-hand head only finish-bores the steel bushing. Several cuts are taken by the left-hand head, however. It finish-bores the bearing seat, faces the bottom of the bore, and cuts an internal lock-ring groove.

The rear transmission extensions A are locked in the fixture in an interesting manner. Both work-pieces are loaded with the external chamfer

Fig. 2. Preliminary operations are performed on this special machine. As the work-table indexes counter-clockwise, the casting is rough-milled, right; drilled, rear; and surface-broached, left.

on their large end, engaging a corresponding tapered surface in a pair of fixture bushings. The opposite ends of the castings are temporarily supported on upright V-posts, one of which can be seen at *B*.

When the buttons at the right are pressed, two short-stroke hydraulic cylinders at *C* are actuated. Both cylinder rams are hollow, having cone-shaped bores that engage the external chamfers on the small ends of the castings. As the rams move to the left, the castings are lifted from the V-posts, centered, and locked firmly in place.

Synchromesh Clutch Hubs Have Internal and External Splines

As was mentioned earlier, the Victor transmission is of a synchromesh design. One member of this mechanism is the clutch hub illustrated in Fig. 8. This unit, which has both internal and external splines, is mounted directly on the main transmission shaft and carries the first-gear clutch.

Clutch hubs start out as bars of medium-carbon steel which are fed to a 2 5/8-inch capacity, six-spindle Cone automatic lathe. The bars are drilled, counterbored, chamfered, and parted off in the form of blanks. These blanks are then hardened, tempered, and shot-blasted.

Further machining is done on the six-spindle, B.S.A.-Acme-Gridley automatic chucking machine shown in Fig. 9. Blanks are placed in a magazine and are automatically loaded and unloaded. In a cycle time of fifty-seven seconds the blanks are bored (with an allowance for spline broaching) and counterbored, face *D* (Fig. 8) is recessed and chamfered, the periphery is chamfered, and the groove separating the external spline is rough-turned. High-speed steel tools are used at a spindle speed of 165 rpm and a feed rate of 0.012 ipr (inch per revolution).

Automatic loading and unloading are carried out by the illustrated attachment (Fig. 9) which consists mainly of air cylinders *E* and *F*, magazine *G*, and discharge chute *H*. Cylinder *E* is mounted on the cross-slide at one of the spindle stations. The cylinder ram, in turn, drives a slide supporting discharge chute *H* in a direction parallel to the spindle axis. A pick-up arbor *J*, having spring gripping fingers, projects from the inner end of the discharge chute.

A second pick-up arbor *K*, attached to the ram of cylinder *F*, is mounted on the hexagonal tool-slide. When the cylinder is actuated, arbor *K* enters the bore of the finish-turned blank. At this point in the cycle the spindle at the loading station has come to rest and the chuck jaws have opened. Reverse movement of cylinder *F* carries the finished part into line with the end of discharge chute *H*.

Just before this sequence is completed, cylinder *E* drives the discharge chute forward, causing pick-up arbor *J* to enter the bore of a rough-machined blank in the magazine. As the chute is returned a blank is carried with it. It is then fed inward by the cross-slide, engaging the finished blank being held on arbor *K*. Forward movement is again imparted to the discharge chute by cylinder *E*, stripping the finished blank from the

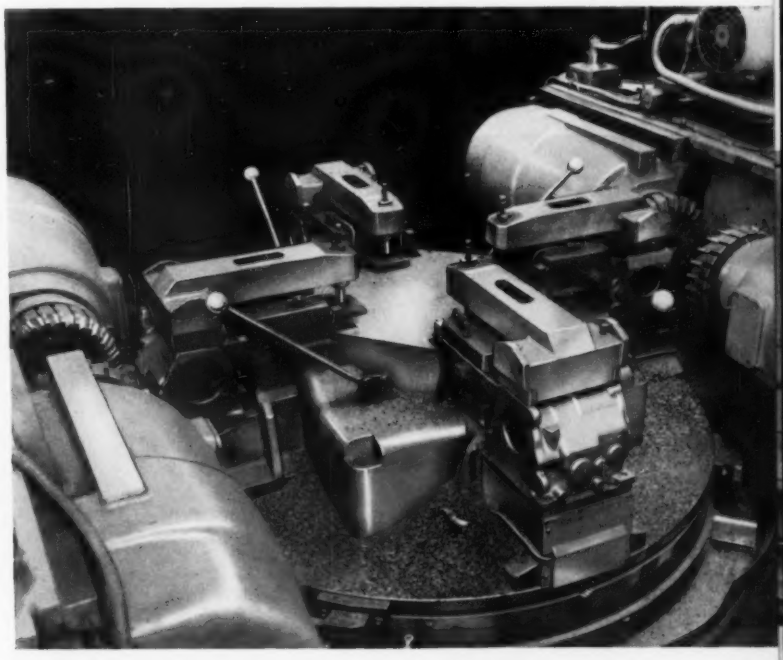


Fig. 3. Two work-stations on this machine straddle-mill the casting end faces. Rough-milling is done by the duplex head at the left, followed by finish-milling at the right.

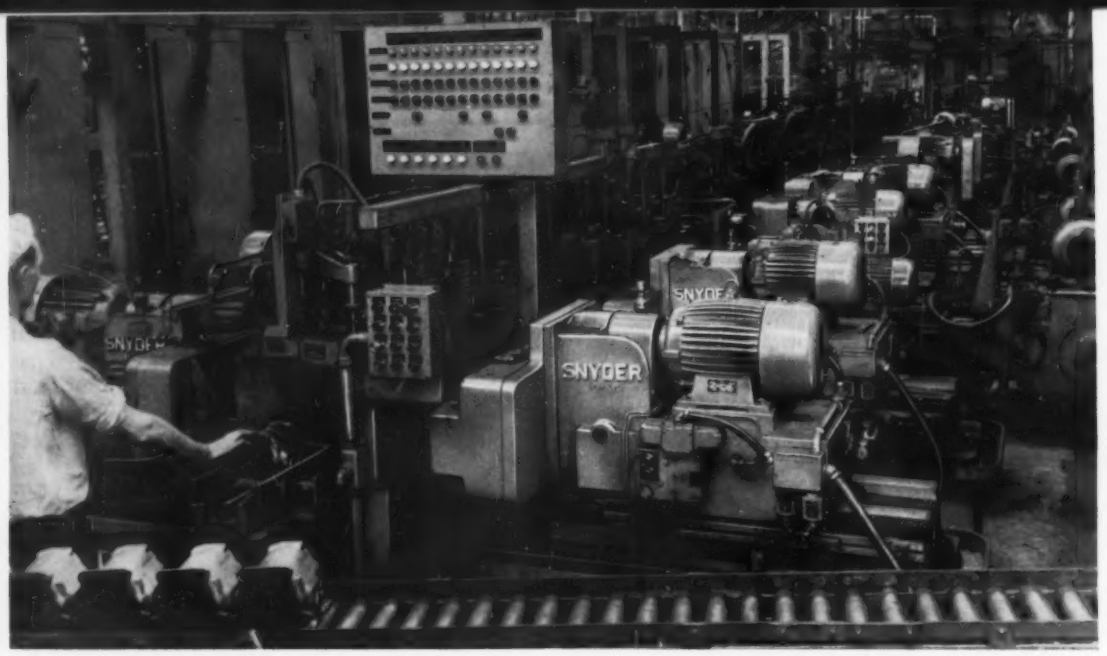


Fig. 4. Loading end of an in-line, fifty-three-station transfer machine. Eighty castings are drilled, reamed, spot-faced, chamfered, bored, tapped, and milled each hour.

arbor and depositing the rough blank in the chuck jaws.

Broaching the internal splines and finish-turning the periphery follow, after which the parts are delivered to a bank of eight Rigid-hobber machines where the external spline teeth are cut. The bank is laid out in two lines of four machines, each line being served by two continuously moving, 3-inch-wide conveyor belts. A loading station of one hobbing machine and the adjacent conveyor belt (lower right) can be seen in Fig. 10.

As the blanks advance they are swept to the machine side of the belt by a fence (not shown). Collector bar *L*, suspended just above the belt at the loading station, guides the approaching blanks into a channel between it and the expanded side wall of the conveyor. The leading blank is stopped and retained in position shown by a flat spring on the far side of the part. Four blanks can be accommodated in the channel at one time, additional blanks being deflected to the right and passing to the next machine in line.

In one phase of the automatic loading and unloading cycle a finished clutch hub *M*, Fig. 10, has been transferred from the machine spindle to a platform alongside the upper of the two conveyor belts. Feed-plate *N*, advanced by a hydrau-

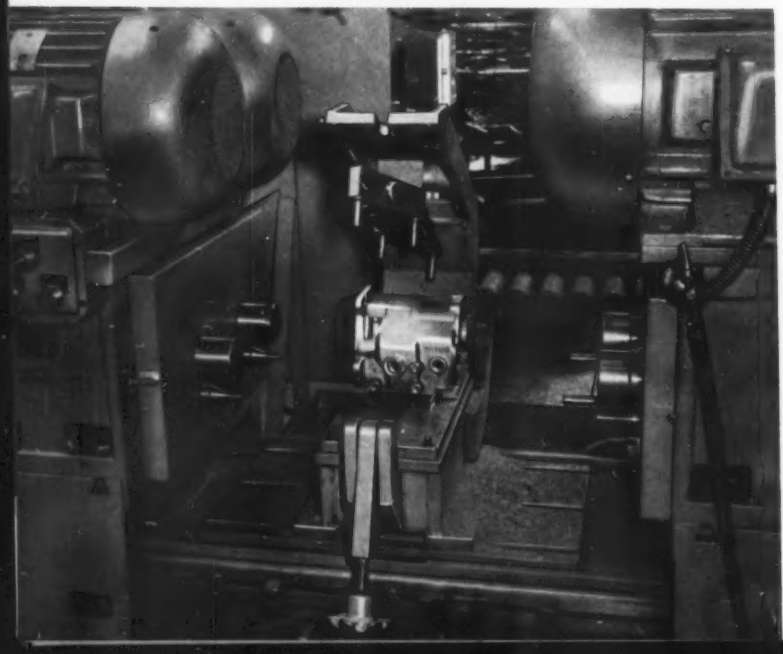


Fig. 5. Ten-spindle precision boring machine handles two castings at the same time. The work-table feeds first to the left and then to the right for the successive boring operations.

Fig. 6. Milling the flange areas surrounding five bolt holes of a rear transmission extension. Three work-heads, driving a total of five cutters, operate at the same time.

lic cylinder, contacts the boss on the underside of clutch hub *M* and pushes it off the end of the platform. The hub drops to the lower conveyor belt which carries it to the far end of the line.

As can be seen, the feed-plate is provided with a U-shaped opening, the forward leg of which has been cut away. When the plate is advanced, its longer leg (rear side of the opening) contacts the boss of the next blank to be loaded and carries it forward. During this movement the blank is deflected to the left by a stationary inclined bar *O* and enters the U-shaped portion of the feed-plate, thus being accurately positioned for loading.

Loading jaws *P*—shown in the open position, Fig. 10—have projections that engage the external groove in the blank as they are closed by a small hydraulic cylinder. The arm supporting the loading jaws is raised, pivoted toward the work area, then lowered to place the blank on the machine spindle. Next, the loading jaws open, the tailstock descends to clamp the work, and the hobbing cycle begins.

Each synchromesh clutch hub is completed in five minutes, including loading and unloading time. The hob-shift mechanism on the machine provides full movement of the 3-inch-long hob in approximately five hours—yielding sixty parts between grinds. Each hob can be reground approximately fifty times.

Mainshaft Oil-Grooves Are Rolled

One of the more interesting operations on the main transmission shaft involves the rolling of oil-grooves. Four annular groups—each consisting

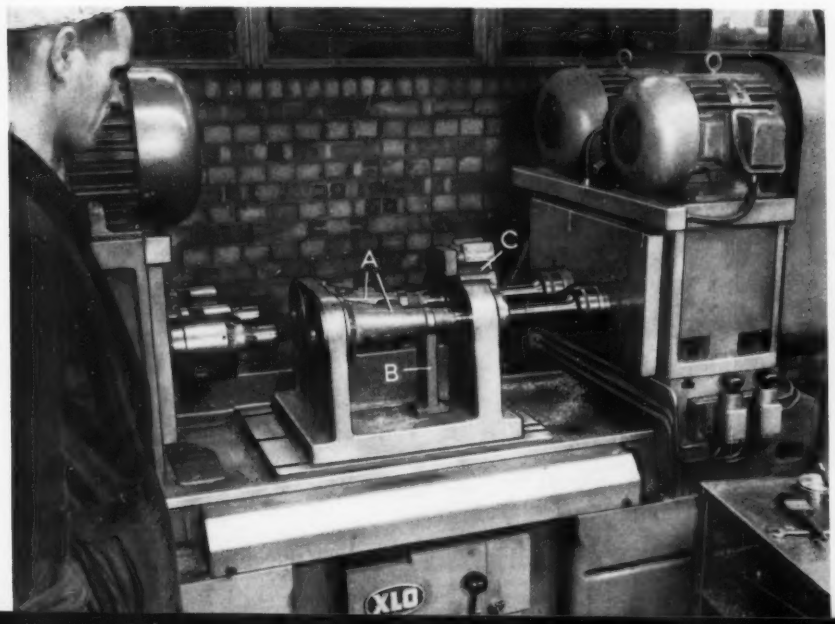


Fig. 7. An inserted bushing is finished on two parts simultaneously, right, by this precision boring machine. Opposite end is finish-bored, faced, and an internal lock-ring groove is cut.

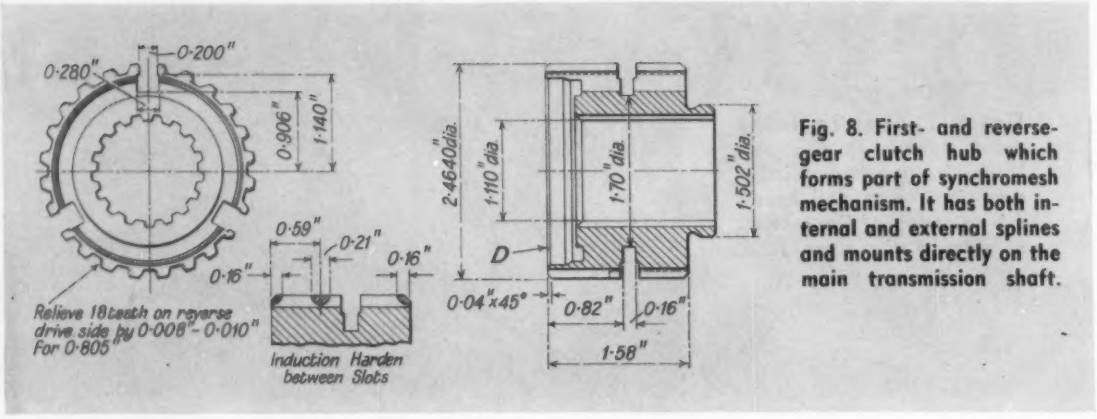


Fig. 8. First- and reverse-gear clutch hub which forms part of synchromesh mechanism. It has both internal and external splines and mounts directly on the main transmission shaft.

of thirty-three individual grooves—are required on the bearing surface that is to support several gears. The grooves are formed in the forged-steel shaft on the Michigan Roto-Flo spline-rolling machine shown in Fig. 11.

Rack type forming tools are carried on two horizontal reciprocating slides which are mounted one above the other at the right in the illustration. The lower oil-grooving tool is indicated at *Q*; the matching tool is secured to the bottom face of the upper slide. A master rack on each slide meshes with connecting gear *R* to interlock and synchronize movement of the forming tools.

The machine is loaded and unloaded automatically—loading being from an inclined magazine on the far side of the over-arm work support, left, Fig. 11. A partly machined shaft rolls from the magazine and, by means of hydraulic fingers, is placed in a work-fixture beneath the over-arm. This movement ejects the just-rolled shaft from the fixture, allowing it to drop into the tote box shown in the foreground.

Spring-loaded pads hold the new shaft on V-blocks while the entire fixture is fed into the work area of the machine. The shaft is then pressed against a stop within the machine frame by a spring-loaded, rotating pad at the left-hand end of the work-piece. Being thus positively located, the upper and lower tool-slides are actuated and the oil-grooves are formed. Cycle time for this operation is approximately eight seconds.

Copy-Turning and Transfer Machining of Steering Knuckles

Steering knuckles for the Vauxhall Victor are machined from alloy-steel forgings. A group of these are shown in Fig. 12 in various stages of manufacture from a rough forging (upper left) to a completed part ready for assembly (lower right).

In a preliminary lathe operation the two bearing surfaces of the stem are rough-turned

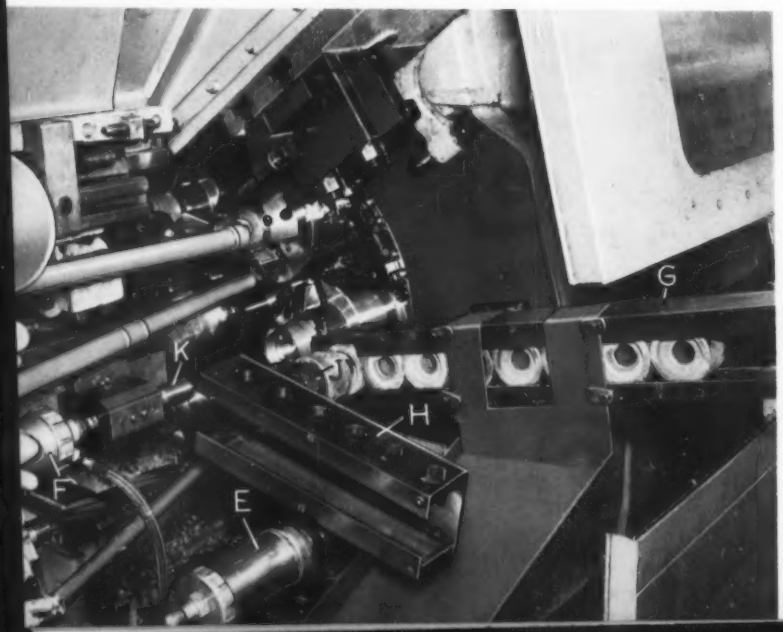


Fig. 9. Loading and unloading attachment feeds clutch-hub blanks to this six-spindle automatic chucking machine. Arbor (J) picks blank from magazine (G) and deposits it in the chuck jaws.

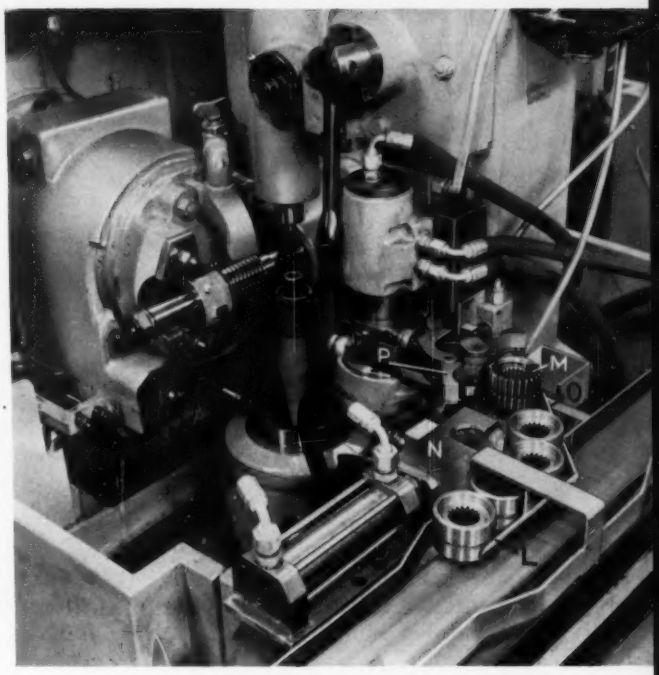


Fig. 10. One of eight hobbing machines for cutting external spline teeth on clutch hubs. Shown here is one of the automatic loading and unloading stations fed by a common conveyor belt.

(1/8 inch being allowed on the diameters) and the flange is rough-faced. The forgings are then brought to a group of four H.E.B. "Pilot" automatic copying lathes, two of which are for roughing and two for finishing. (Pilot copying lathes are now being manufactured by the Cone Automatic Machine Co., Inc.) Here, entire steering knuckle stems are machined, including the flange face, both bearing diameters (0.010 inch left for grinding), and the tapered center section.

A typical setup for rough-turning is illustrated in Fig. 13. The work-piece is held between centers and is driven by the kingpin extension which engages a slot in the spindle adapter.

Two tool-blocks—one on each side of the work-piece—are mounted directly on the inclined cross-slide. During the automatic machine cycle the carriage advances at various rates while the transverse movement of the cross-slide is controlled by stylus S of the hydraulic copying valve (mounted behind, but not to, the slide). Because the hydraulic cylinder of the copying unit is integral with the carriage and the piston is connected directly to the cross-slide, no compound slide is required.

A number of individual templates are mounted permanently on a shaft to form a master. This master is held between centers on an overhead bracket (top, Fig. 13).

At the start of the cycle the master rotates counterclockwise, as viewed from the right. When stylus *S* contacts flat surface *T*, the cross-slide is fed upward to the rear of the machine, permitting the lower tool to face the end of the stem. At the end of this movement a limit switch is tripped, the master stops rotating, and the carriage moves to the left. Now the stylus follows flat template *U* which controls the taper turning. Additional limit switches are used to start and stop master rotation and carriage advance so that the individual template members can control the action of the cross-slide.

When the carriage has completed its travel to the left, the slide is moved downward. Two tools mounted in the upper tool-block face the flange,

Fig. 11. Cold-forming four rows of oil-grooves in bearing surfaces of main transmission shaft. The spline-rolling machine is magazine-fed from the opposite side of the over-arm work support.

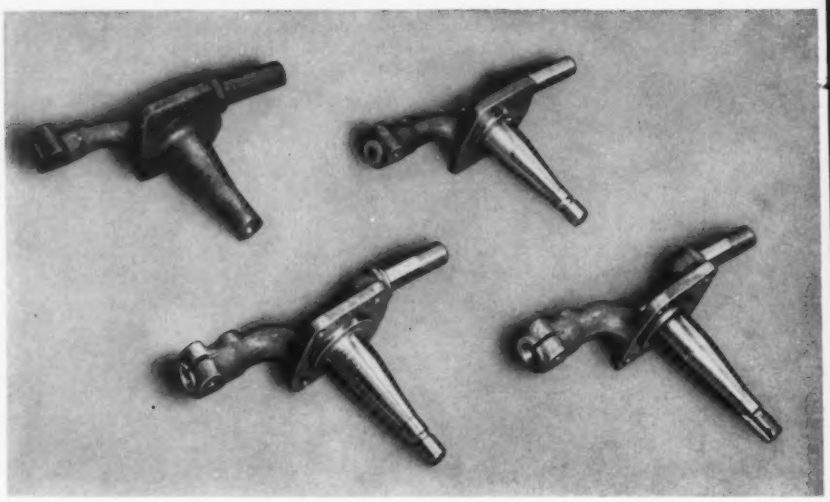
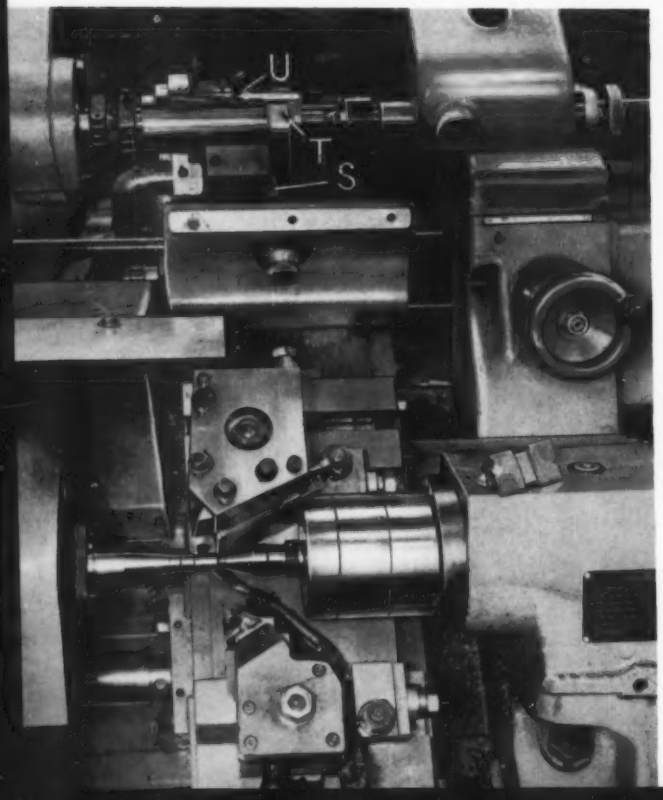


Fig. 12. Alloy-steel steering knuckles are shown at various stages of completion from a rough forging, upper left, to a finished part, lower right.

plunge-form a narrow shoulder, and face this same shoulder. Carriage travel is then reversed and the two tools in the upper block turn both the narrow shoulder and the large bearing diameter.

Most of the remaining operations finish the kingpin extension and are completed on a twenty-six-station Snyder transfer machine. This 60-foot-long, pallet type machine is shown from the loading end in the heading illustration. Operations carried out include conventional milling, hollow milling, drilling, spot-facing, reaming, and tapping. A rate of 146 parts per hour is obtained.



Each of the pallet type fixtures accommodates two work-pieces, and identical work is performed on both parts at each station. As can be seen in Fig. 14, the fixture has smooth, uncomplicated surfaces wherever possible to prevent steel chips from collecting. A feature of the pallet is the sloping surfaces at either end. As the pallets advance through the transfer machine they contact one another. The inverted vee at each end nests with the corresponding inverted vee on the end of the adjacent pallets. This arrangement minimizes the quantity of chips that can fall between the pallets and onto the track beneath.

Locating and clamping of the steering knuckles in the fixture at the loading station is of interest. The fixtures are designed to support the stem portion at an angle so that the kingpin axis is horizontal. Locating and supporting arrangements can be clearly seen in Fig. 15. Two sections through the fixture are shown, the left-hand view being taken at the point occupied by the work-piece. This illustration shows that the stem is located at two points: the small bearing diameter in a close-fitting bushing, and the narrow flange shoulder in a counterbored collar.

Angular positioning of the kingpin extension is controlled by the V-shaped top of plunger *V*. A cam surface on the bottom of this plunger rides on a matching cam surface on the top side of plunger *W*. A compression spring behind this horizontal plunger drives it as far to the right as is permitted by the position of plunger *V* so that positive contact is made with the work.

Fig. 13. Rough-turning steering knuckles on an automatic copying lathe. Two tool-blocks are carried on an inclined cross-slide that is controlled by a master template assembly (top).

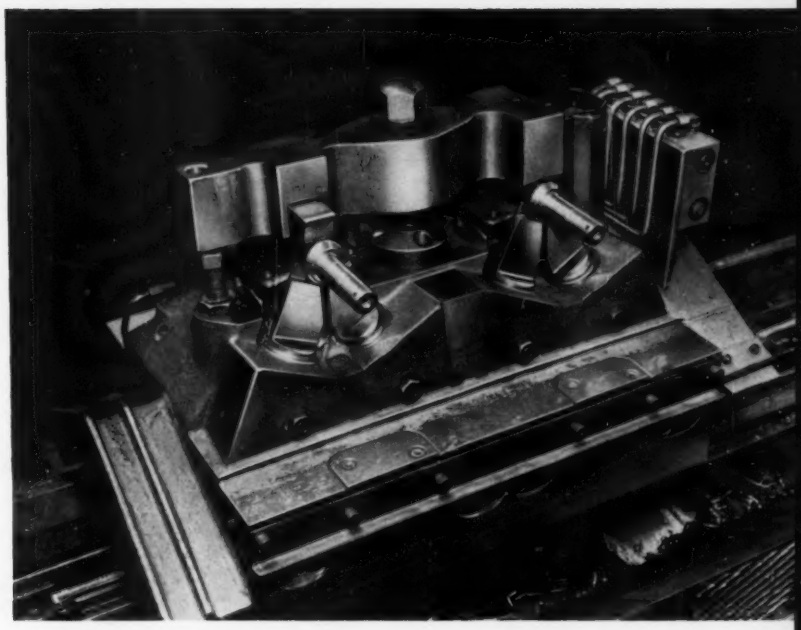
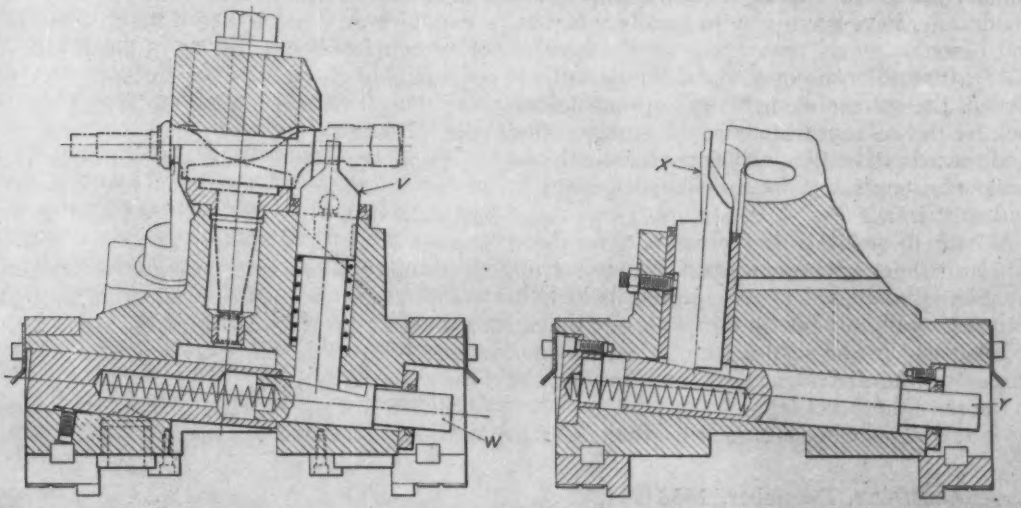


Fig. 14. Pallet type fixture used on twenty-six-station transfer machine shown in the heading illustration. Each fixture holds two parts while the kingpin is finished.

When the empty fixture is positioned at the loading station, machine-mounted hydraulic rams advance, contact plunger *W* (two plungers on each dual fixture), and force them to left. This permits the vertical plunger to lower slightly. Steering knuckles are then placed in the fixture and the clamping screw is tightened automatically by a Thor air-operated impact wrench. At this point the hydraulic rams retract, the compression spring drives plunger *W* to the right, and plunger *V* is forced up into contact with the work.

While this is happening, a similar combination of movements is taking place between another set of machine-mounted hydraulic rams and plungers *X* and *Y*. These are shown in the second section through the fixture, right, Fig. 15. Two pairs of these plungers are provided for each part held in the fixture. Their purpose is to support the kingpin extension against pressure of the cutting tools. The two pairs of plungers *X* can be seen in contact with the kingpins in Fig. 14. Operation of the various sets of hydraulic rams is timed so that plungers *V* can position the parts before plungers *X* are permitted to rise.

Fig. 15. Two sections through the fixture shown in Fig. 14. Left view is at point occupied by one of the work-pieces. Right view cuts through one of the kingpin support plungers.



New Press Line,

FOR THE General Motors Corporation, 1959 can claim the distinction of ushering in some of the most elaborate line-wide styling changes of any single model year. In the Buick Motor Division these changes did not stop with body design, but embraced its series identification as well: the familiar names of Special, Century, Super, and Roadmaster have given way to LeSabre, Invicta, and Electra.

As a natural consequence, and especially in view of the automobile industry's optimistic outlook for this sales year, one would expect to find modernized production facilities to handle the redesigned components in anticipated quantities. And so it is.

A case in point is the press line for hood panels in Buick's stamping plant. Newly set up, the line is composed of five presses linked together by fully automatic handling equipment. It is laid out in the shape of an "L", with three presses on the first (long) leg and two presses on the second (short) leg.

Material for the hoods is supplied to the stamping plant in the form of coils. They undergo preliminary processing in a separate line so that conditioned blanks can be delivered to the main hood line. Coils of SAE 1008 steel (or its equivalent) are transferred from a loading rack to a McKay cone type holder by a coil car shuttling back and forth on rails. As the 0.045-inch-thick steel unwinds, it is pulled through a second McKay unit by an integral set of pinch rolls and is thoroughly cleaned by solvent sprays. A film of the solvent remains on the metal and serves as a die lubricant.

From the exit side of this unit the material loops down into a deep storage pit, then up to the straightening rolls of a roll-feed unit at the entrance side of a blanking press. Pinch rolls in the feed unit pull the strip through the straightening rolls and advance it to the Clearing straight-side crankshaft press. A gang die is used, with two tapered hood blanks being produced at each stroke of the press.

Blanks are stacked on a pallet and brought to a McKay Flex-Roll processing machine. They are

New Handling Equipment, New Car

Each hour, two hundred hood panels are drawn, trimmed, flanged, and pierced on a recently installed, five-unit press line. Completely automatic handling equipment loads and unloads the dies, flips over the drawn parts, and transfers them between presses. At two stations, cam-operated dies perform the flanging, restriking, and piercing.

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fed into this unit one at a time. In the first zone of the machine the blanks are thoroughly washed to remove all traces of dirt or metal particles that may have been forced into the surface during sequent operations. Before leaving this machine the work passes between groups of rolls that flex it en route, the net effect being to relieve any internal stresses that might be present in the metal.

Double-Action Draw Press Heads Main Line

Stacked blanks, carried on welded-steel pallets, are delivered from the Flex-Roll machine to the beginning of the main hood line. Each pallet, in its turn, is centered on the platform of a hydraulic lift (at floor level) by means of which it is elevated to the upper end of an inclined mechanical loader, heading illustration.

Blanks are lifted from the stack by an operator and pushed forward, one by one, onto free rollers forming the short, inclined section at the rear of the loader. (This is the only time the work is handled manually along the press line.) Free forward movement of the blank is arrested by two stops at the far end of the loader.

A pair of feed-fingers, borne on a shuttle carriage beneath the flat section of the loader, contact the back edge of the blank and, as the stops are lowered, advance it between the uprights of the lead press. At the end of this movement, the blank drops onto the lower draw-ring of the draw die and the shuttle carriage retracts to its original position. A pneumatic cylinder can be seen mounted at the right of the lower draw die in the heading illustration. After the blank has settled on the die the cylinder is activated, nudging the work slightly to the left and into positive contact with locating pins.

This lead installation is a Danly double-action press with a bed measuring 156 by 102 inches. Capacity is 800 tons on the inner slide and 500 tons on the blank-holder. On the down stroke, the outer slide (blank-holder) first contacts the edges of the work, firmly clamping the steel sheet in place. The inner slide continues its downward travel, strikes the blank, and draws out the desired hood configuration.

Between the draw and trim presses is a two-section, work-handling installation, Fig. 1, consisting of a dual-jaw unloader and a turnover, transfer, and loading machine. In this illustration work flow is from the exit side of the draw press, right, to the entrance side of the trim press, left. The combination turnover unit is but one segment of the pneumatically operated handling system (engineered and built by Press Automation Systems, Inc., Warren, Mich.) tieing the hood press line together.

At the end of the draw stroke, two pneumatic gripper-jaw assemblies *A* grasp the edges of the shaped panel. They are then pulled up the inclined tracks *B* by a sprocket chain, removing the hood panel (which is in an inverted position) from the draw die and depositing it on a pair of counterweighted intermediate arms *C*.

Inversion of the hood is executed by coordinated movement of two pairs of arms—one of each pair being designated *D* and *E* in Fig. 1—comprising the butterfly turnover unit. Arms *D* pivot up from beneath the hood, nest it, and swing it up and over as illustrated. In synchronization, arms *E* pivot up in front of the hood and contact it in an approximately vertical position. At this instant they reverse direction of travel. Once the work has passed over center its support is shifted to this second pair of arms, the first pair

Fig. 1. (Left) Two-section turnover unit of automatic work-handling system. Formed hood is extracted from the draw die in press at right. It is shown being inverted before loading into trim press at left.

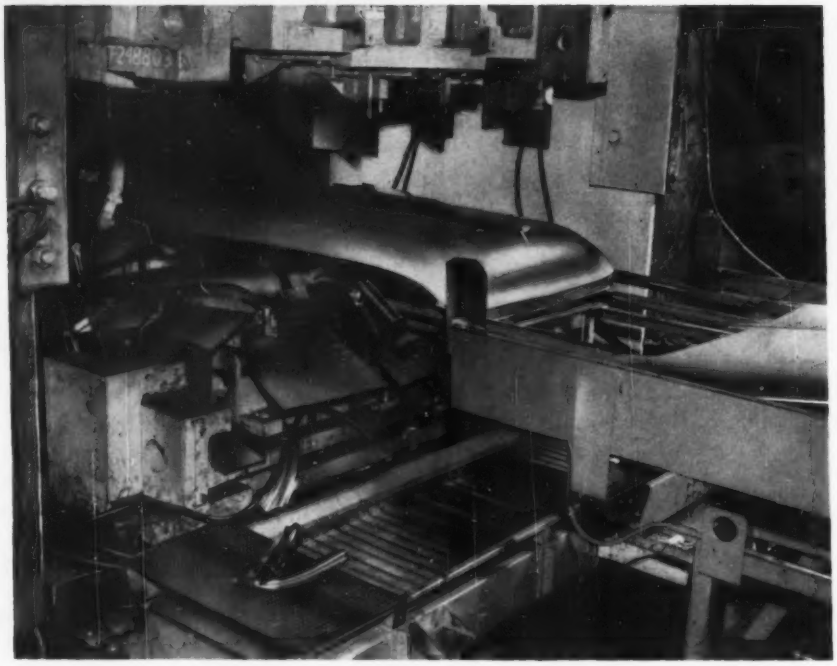


Fig. 2. (Right) Exit side of trim press. Ejecting arms housed in lower die member are carrying hood from the press to a transfer unit at right. Scrap conveyor can be seen below the formed part.

returning to its original position for the next cycle. The hood is thus lowered until it rests in a horizontal position—right side up—on a pair of tubular rails (one can be seen at *F*).

A last phase in the work-handling cycle of this particular unit is the forward movement of a shuttle type feed carriage. The hood is advanced into the work area of an 850-ton, Clearing single-action mechanical press (left, Fig. 1) and placed on the trimming die. A safety interlock on the turnover unit holds the press-run circuit open until the arms have been retracted. A second safety interlock in the same circuit is closed by contact with the hood lying on the lower die member, but then only when the work is properly positioned.

During this second operation on the line the hood is completely trimmed, with the exception of two small manufacturing tabs having a punched hole. They protrude from the back end of the hood and are used for locating purposes in the third operation.

As the ram ascends, steel fingers, extending horizontally from beneath the upper die, engage scrap-ejector plates surrounding the lower die. These are forced to swing upward and outward,

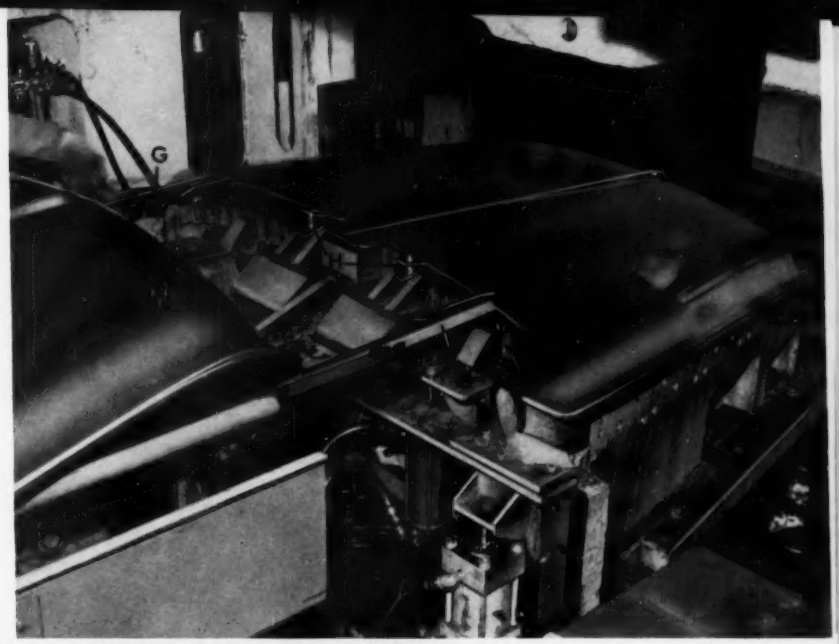


Fig. 3. (Right) Hood is dropping in place on die in the third of five presses. Positive location is by means of tabs engaging locating pins at (H). In this step, all hood flanges are turned downward 90 degrees.

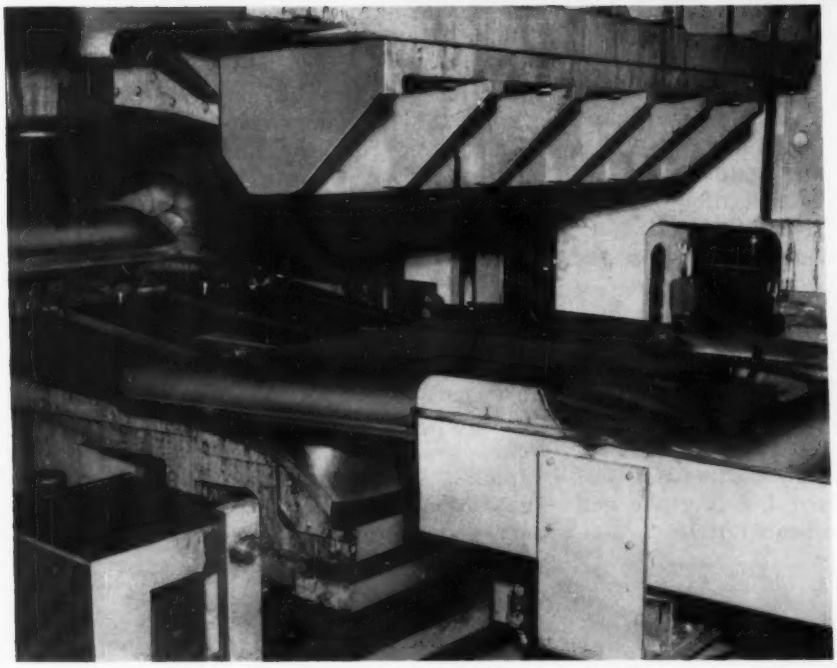


Fig. 4. (Left) In the 90-degree flanging operation the manufacturing tabs are sheared off. Here, as the press ram rises, ejecting arms pivot up and forward from the die, advancing hood to pick-up station of a positioning table.

thereby dumping the steel trimmings clear of the immediate die area. The trimmings drop onto two continuously moving scrap-conveyor units, one serving the front of the press and one serving the rear. Both discharge onto a third independent conveyor unit that parallels the press line and terminates at an elevator-fed hopper. Steel scrap is stored in this hopper until released into gondola cars that are pulled to baling machines by a small tractor.

Two long, parallel recesses run from the front to the rear of the lower trim die. Housed in each of these elongated openings is a contoured ejecting arm. When the press cycle has been completed, these arms rise from the die surface and pivot forward, carrying the hood with them, Fig. 2. (The lateral scrap conveyor can be seen beneath the trimmed hood.)

Forward movement of the ejecting arms is just sufficient to shift the nose of the hood to the transfer unit shown at the right in the illustration. At the proper moment—as dictated by an intricate sequencing circuit—a multiple-station shuttle carriage moves toward the trim press and a pair of spring-loaded fingers engage the inside of the hood nose. A reverse movement of the shuttle car-

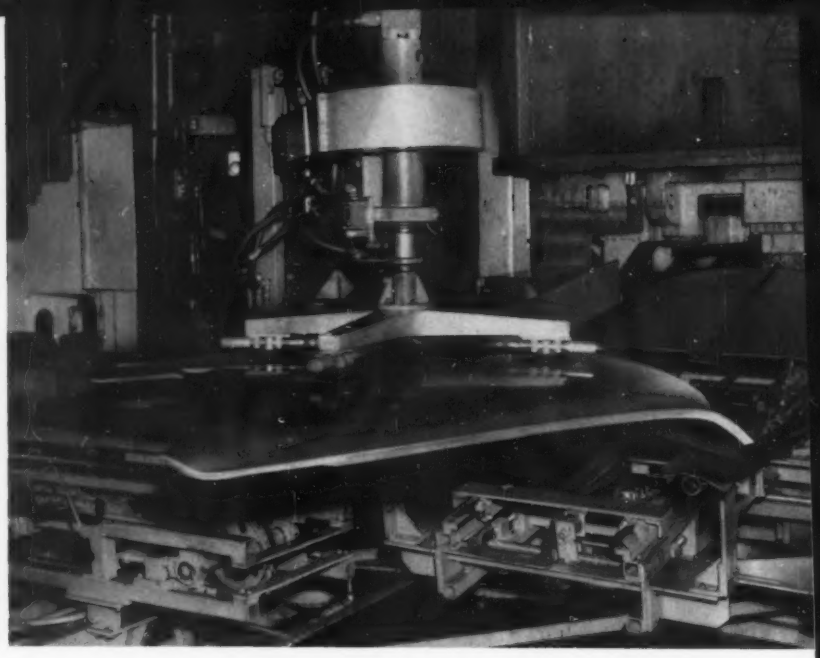


Fig. 5. Radial-arm transfer unit at the bend in the L-shaped press line. Four rubber vacuum cups grip the smooth metal panel, delivering it from the positioning table after the third press (left) to a loading fixture for the fourth press (right).

riage pulls the work clear of the die and places it on fixed tubular rails.

Reciprocation of this transfer unit transports the work through three idle positions before delivering it to the third work station in the line, another 850-ton, single-action Clearing press. To load the die, the hood is advanced by the shuttle carriage, the down-turned nose being supported by two semicircular carriage extension arms. As the hood passes into the work area, the nose slides down into position over the forward die surface. When the feed carriage retracts, extension arms *G*, Fig. 3, slide out from under the formed part, allowing the back of the hood to drop onto the die. Positive location is assured by the two manufacturing tabs, which engage locating pins just outside the main die surface. Locating pins and manufacturing tabs are indicated at *H*.

In this setup, flanges around the entire hood are formed downward to an angle of 90 degrees. Also, as the upper die member strikes home, the manufacturing tabs are sheared off. The small scrap pieces are stripped from the locating pins by ejector chutes and drop into pans on the lower die-shoe.

After the die has opened, a pair of ejecting arms lift the formed part clear and pass it on to the pick-up station of a positioning table, Fig. 4. As was the case following trimming, only the front end of the work rests on the table at this point. Fingers of a reciprocating carriage then grasp the nose end of the hood, remove it from between the dies, and shuttle it forward to a transfer station leading to the turn in the press line. This marks the end of the first, or long, leg of the L-shaped press line.

Fig. 6. After being transferred around a 90-degree bend (Fig. 5), the hood enters a cam-flanging die. Forming slides straddle the lower die and are forced inward when wedge-shaped cam drivers (J) strike cam surfaces (K) on the slides.

Vacuum Lifter Steers Hood Around Corner

A radial-arm transfer unit is located at the inside corner of the right-angle bend in the hood line, Fig. 5. It, too, is operated pneumatically. A large, vertical air cylinder, carried by the radial arm, is swung into alignment with the hood waiting at the end of the positioning table just described. On the exposed face of the cylinder ram is mounted a large spider with rubber cups beneath each of its four legs. The rubber cups prevent marring of the hood.

When the ram is lowered into contact with the hood, air is evacuated from the rubber cups, giving them a firm grip on the smooth metal panel. The ram is then retracted to raise the hood from the positioning table. In the sequent movement the horizontal arm swings through an arc of 90 degrees, stopping at a point directly over the back end of a loading fixture, right, Fig. 5. The hood is lowered onto rails, the rubber cups are released as air is reintroduced to the vacuum circuit, the ram is elevated, and the radial-arm transfer unit is ready for recycling.

A shuttle mechanism advances the work to a loading position in front of the fourth press. During the next movement the hood enters a cam-flanging die, Fig. 6. Three wedge-shaped cam drivers—two of which are noted at *J*—are bolted along each side of the upper die. When the press hits, the drivers are forced into contact with mating cam surfaces on forming slides that straddle the lower die. Two of the lower cam surfaces can be seen at *K* in the illustration.

The two forming slides, which extend the length of the die on either side, are driven inward. In doing this, they reshape the flange along both sides of the hood, folding it under about 25 degrees. The cam-flanged part is shown in Fig. 7 as it is about to be unloaded.

A pair of ejecting arms housed within the die deposit the formed part on a transfer table similar to those already described. The hood shuttles past two stations, arriving at the fifth, and last, press (850-ton) in the line. In this operation the work is restruck, the nose end is reflanged, and all required holes are pierced.

The die used here, as with the die in press No. 4, utilizes wedge-shaped cam drivers to effect horizontal movement of the forming and piercing slides. A large cam-driver casting can be seen suspended from the upper die at *L* in Fig. 8. (The hood shown has completed this step and is being unloaded.) The three prominent contact surfaces at the rear of this member serve as backup points during the strike.

Proper positioning of the work in the die closes the press-run circuit and the ram descends. As the die closes, the tapered surface of the cam driver *L* makes three-point contact with corresponding cam surfaces of a forming slide in front of the lower die. One of the three cam surfaces at the back of the slide is pointed out at *M*.

First to occur is a restriking of the hood which also serves to clamp the part in place. The die-pad that contacts the work at this point is attached to the upper die-shoe by keeper blocks and is under spring load. Therefore, although this pad has struck home and its downward motion has been stopped, the ram continues to advance.

Next, the forming slide is forced into the work by cam action. It restrikes the nose section of the hood and turns back the bottom edge of the nose flange through an angle of 90 degrees, creating a lip that points toward the rear. With the nose

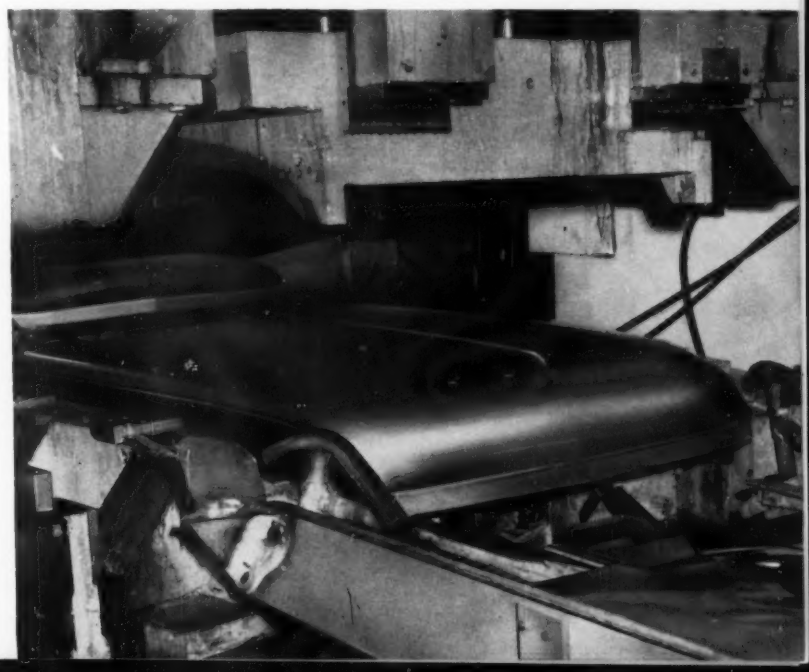


Fig. 7. When the forming slides (Fig. 6) strike home, they reshape the flange on both sides of the hood, folding it under about 25 degrees. The part shown here has been cam-flanged and is about to be ejected from the press.

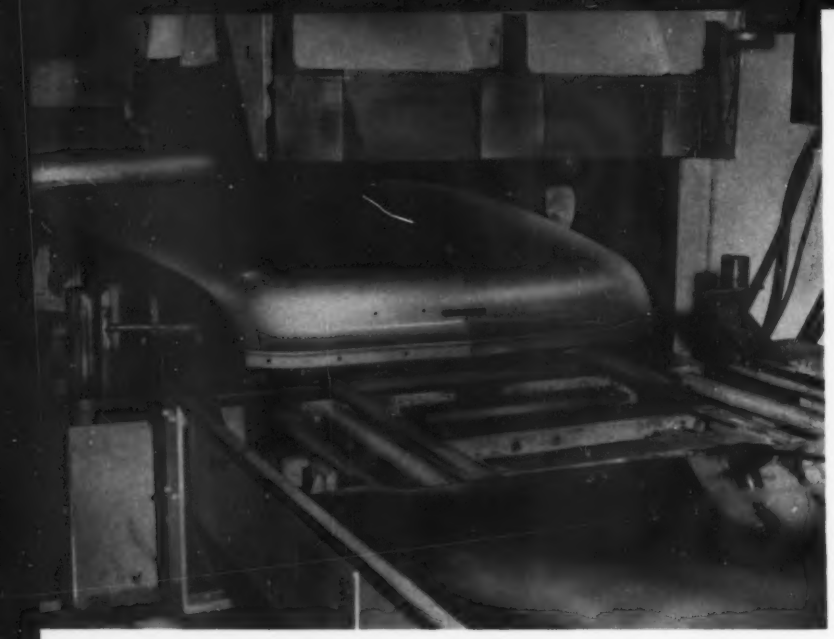


Fig. 8. The last press in the line. At this point the hood is first restruck. Further ram travel brings wedge-shaped cam driver (L) against slide (M), restriking and reflanging nose section, and piercing holes for mounting a trim strip and nameplate.

section thus clamped solidly against the lower die, continued movement of cam driver *L* forces a group of punches through the pad to pierce the hood. Pierced along the flange are the holes for mounting a trim strip; and at the center of the nose section the holes for mounting a nameplate.

Another shuttle type transfer unit at the exit side of this final press receives the completed hood. It is advanced to the end of the unit, then picked off by hand and placed on the checking fixture illustrated in Fig. 9. At this point the contour is given a preliminary check. Special attention is given to the surfaces that are to meet the fenders and the grille.

The parts are then hung from conveyors and carried past a highly illuminated inspection station where they are carefully viewed for surface defects. Farther along the conveyor line is the hood finishing area. Before reaching this point the hoods are removed from the line and given a more thorough check for size and contour. They are mounted on hinges and inspected under assembled conditions. Then—back to the conveyor and on to finishing.

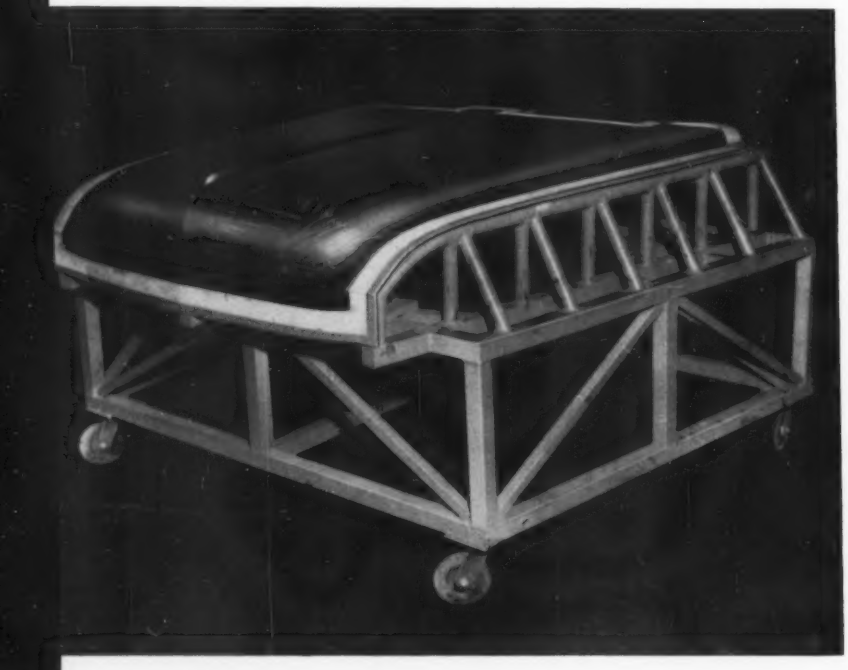
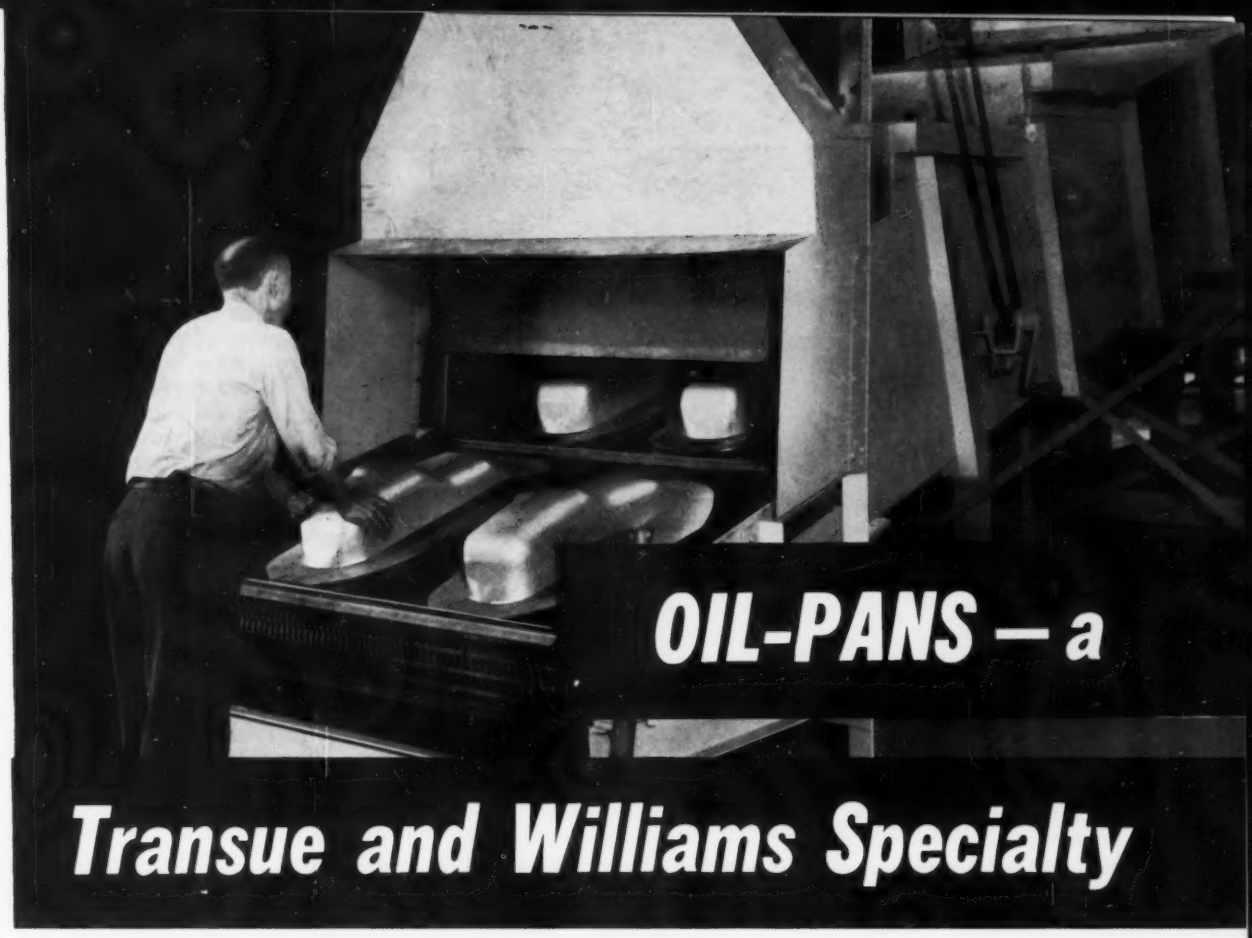


Fig. 9. After leaving the press line, the formed part is placed on this inspection fixture. A preliminary check is made of the hood contours, especially of those surfaces that are to join the fenders and grille.



OIL-PANS — a Transue and Williams Specialty

The unglamorous, but important, oil-pan attached to the bottom of car and truck engines is a more complicated item to produce than casual observation would disclose. Involved in its manufacture are drawing, heat-treating, and welding operations.

STAMPINGS AND FORGINGS for auto and truck engines comprise a substantial part of the business of the Transue & Williams Steel Forging Corporation, Alliance, Ohio. Oil-pans, for example, (seen entering the furnace in the processing stage shown above) are "old hat" to the company's Metal Stamping Division. T & W has been a major source for these pans, particularly for truck engines, for about fifty years. Its production methods, moreover, have remained progressive and are therefore worthy of review.

The pans are fabricated from 16- or 18-gage low-carbon steel sheet. In the first operation, the sheet is sheared to blanks of suitable size. Mechanical presses equipped with ductile iron dies then deep-draw the blanks in two steps.

Because of the drastic deformation of the metal, an annealing operation, seen in the heading illustration, is performed between the draws to relieve working strains. The work moves up the conveyor chain of a continuous furnace, entering a 20-foot-long oven section. A controlled atmosphere of 1450 to 1850 degrees F. is maintained within the oven by natural-gas burners in radiant tubes. When the work traverses the oven, it enters an 80-foot cooling section. Cold water circulates in coils above rollers on which the pans are conveyed, cooling them sufficiently (to approximately 200 degrees F.) to avoid scale or discoloration.

Following the second draw, the oil-pans are struck and trimmed on the 550-ton Bliss press seen in Fig. 1. This is a double-crank, straight-side press, equipped with hydropneumatic cushions. Pans advance in sequence from the striking station at the right to the trimming station at the left.

Next, the flange remaining around the oil-pan after the trimming is curled on an 1100-ton press. To reinforce the flange, 3/16-inch-thick steel

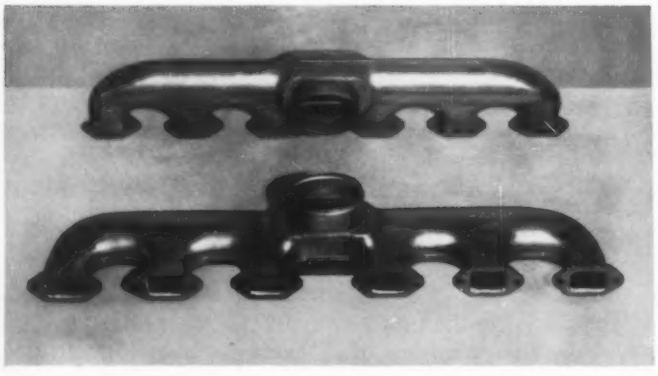
Fig. 1. After two draws, the pans are struck and trimmed in this press. Simultaneously, a pan is struck at one station and the preceding pan is trimmed at the other station.

strips are spot-welded on its underside. The operation, shown in Fig. 2, is performed on a 50-kva Federal spot-welder.

Holes to accommodate fastening screws are pierced in the flange, and the pan is restruck to final shape. The last press operation consists of piercing a hole for the drain-plug bushing in the bottom of the pan. Small steel reinforcing pieces are then spot-welded in the four corners, as is the drain-plug bushing. Some of the pan designs call for baffles, which are also welded in at this time.

In Fig. 3 are shown the cleaning operations which follow. After an alkaline wash and hot-water rinse in the unit seen on the left, the pans are conveyed by monorail to the series of tanks on the right. The first of these is a 5 per cent sulphuric-acid pickle to remove welding scale and rust. The second is a hot-water rinse, and the third, a neutralizer.

In an inspection room, the pans are leveled and fitted to a fixture. Welded areas are chalked, then gasoline is applied to the outside. Any porosity is indicated by a change in the color of the chalk. In another method, shown in Fig. 4, the pan is clamped down over a rubber gasket on a fixture. Soapy water is poured around the welds, and air under pressure is introduced into the fixture. Any bubbles in the water indicate porosity in the weld area.



IN A significant departure from an accepted practice, Transue & Williams is now producing intake manifolds for truck engines by stamping and welding techniques. Traditionally, manifolds have been castings. The new manifolds are claimed to be inexpensive to fabricate, and weigh considerably less than their cast counterparts. The body is 33 inches long and made of two halves of 18-gage sheet formed and welded together. The six glands, or port pieces, are stamped from 5/16-inch plate and brazed to the body.

Fig. 2. (Right) To reinforce the flange, steel strips are spot-welded to the underside following a press curling operation. Later, holes are pierced in the oil-pan flange.

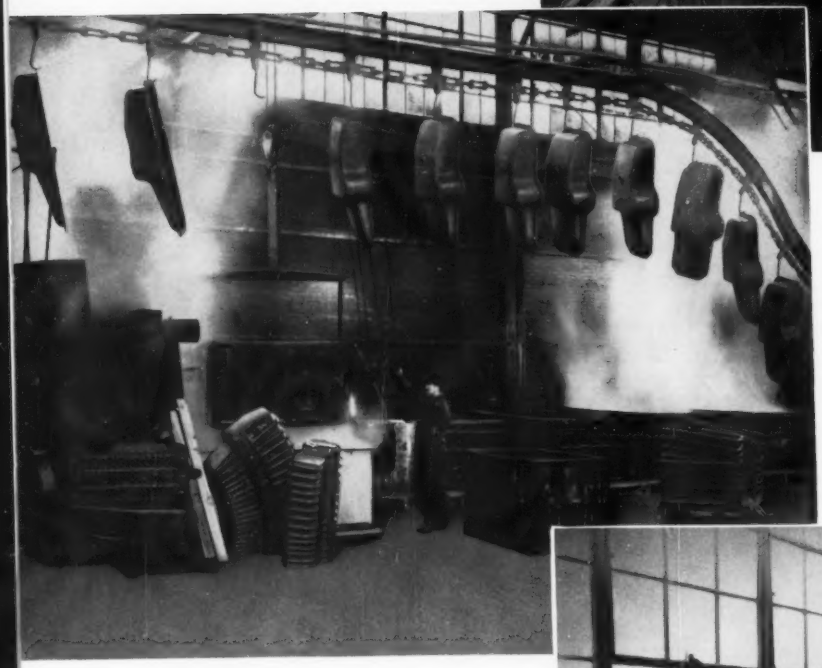
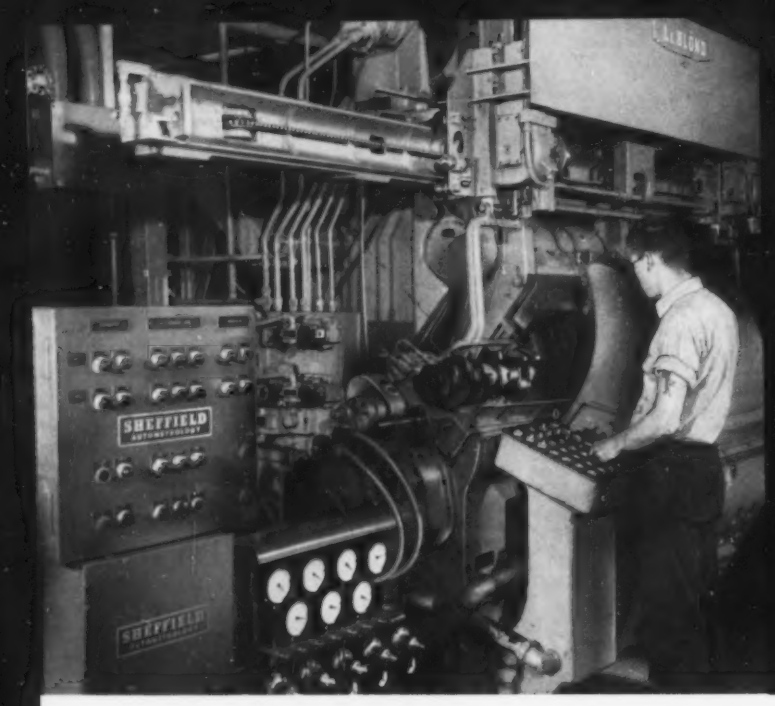


Fig. 3. (Left) After an alkaline wash and a hot-water rinse, the pans travel overhead to a pickling tank.

Fig. 4. (Right) The pan on the fixture, for a military truck engine, undergoes an air test for leaks in weld area.



Lima Engine Plant Shows Off Ford Automation

MAIN BEARINGS of the crankshaft are rough-turned on this LeBlond center-drive lathe. Loading, unloading, and post-process gaging are entirely automatic. The crankshafts require relatively light stock removal.

ENGINES for Mercury, Lincoln, Edsel, and Continental automobiles are built in a new plant that is a veritable automatic factory. The facility, located in Lima, Ohio, further refines the manufacturing techniques embodied in the Ford Motor Co.'s three other engine plants. Cleveland Engine Plant No. 1, it will be remembered, pioneered in the practice of automation just seven years ago. It was followed in 1953 by a completely renovated Dearborn, Mich., engine plant. In 1955, the second Cleveland engine facility—Plant No. 2—went into production.

The complicated network of automatic machines that characterized automation's early days is gone from the Lima plant. Parts flow evenly and smoothly through long, but simplified, production lines.

An outstanding development in the new plant is the processing of crankshafts. Weighing eighty pounds, the work-pieces are handled with ease as they move automatically through a series of machine tools in one of three identical 588-foot-long lines. At the various stations along the lines, the crankshafts are lifted, revolved, and positioned with pin-point precision.

Multiple-station quality-control gages are built into many of the machines, and the work is inspected thoroughly before advancing to the following operation. If a crankshaft does not meet specifications, the gage rejects it and production halts. The trouble area is indicated on a control console, and tooling must be corrected before production can be resumed.

Perhaps the most ingenious equipment in the plant is that used for balancing the crankshafts. Electronic units which determine the unbalance are tied in with drilling units which remove metal from the counterweights. The machines test their own work and, if the crankshafts are out-of-balance after the initial drilling, repeat the operation automatically.

The cylinder-block line is simple and compact, permitting considerable production equipment to be used in the same area. A number of operations, which in older plants required a series of machines tied together by transfer devices, are combined in a single in-line machine. Gun-drilling machines incorporated in the cylinder-head line are highly accurate, and are approximately three times as fast as conventional equipment.

All of the automation equipment in the plant is controlled hydraulically. Proximity switches have been used extensively to activate transfer equipment. Since they never come in direct con-

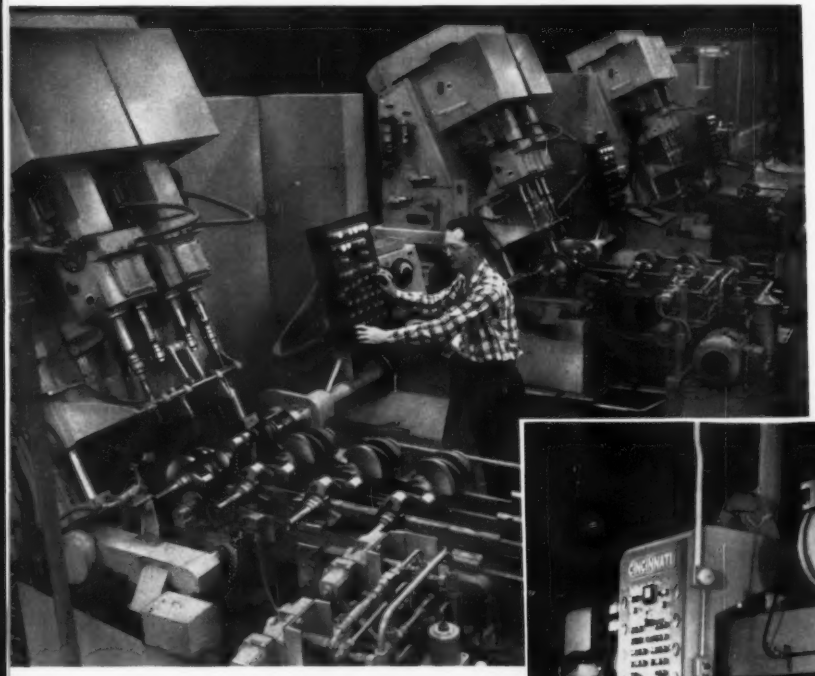
tact with the work, the switches are relatively trouble-free.

Piston-pins are produced by cold extrusion, resulting in considerable material saving. Small steel slugs are positioned automatically in a special press. Then carbide punches mounted on opposing rams strike the ends of the slugs, squirting the metal into the dies and forming a piston-pin. Again, the pin is struck—this time by flat punches which square the ends—then is automatically ejected from the press. Over 1900 pins are extruded per hour.

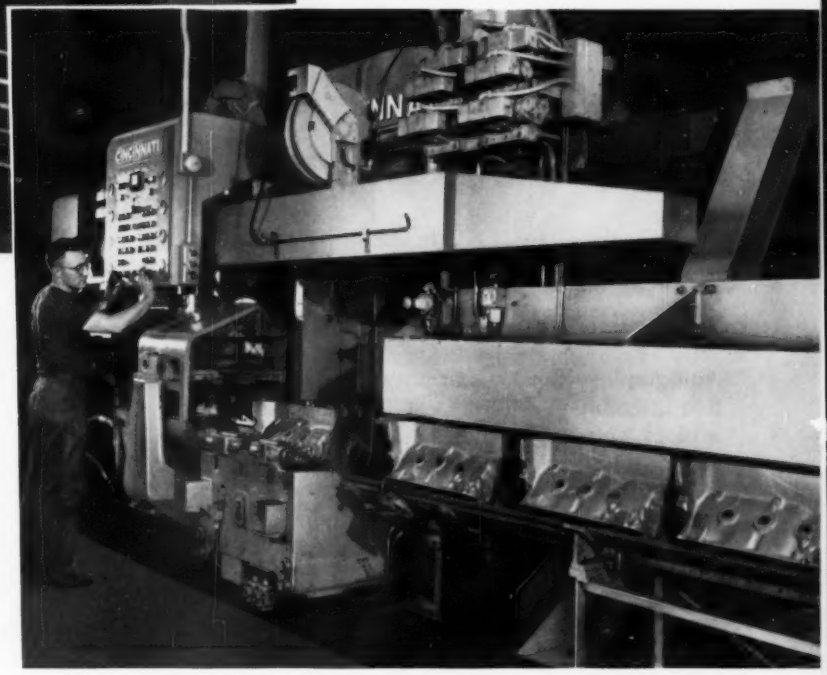
An electronic machine, located in a temperature-controlled room, is used for the precision inspection of all pins before they are sent to assembly areas. The pins are fed into the machine in rapid-fire order and are sorted into three different classifications according to minute differences in size and weight.

Telephones solve the problem of communication along the lines. The problem is particularly acute when breakdowns occur at the far end of a line and the control console for that line is located at the start of the operation. When a breakdown occurs, the operator directs the maintenance man to the trouble area, where he plugs in his earphone and remains in constant touch with the control console while making the necessary adjustments. Also, when regular preventive maintenance tool changes are scheduled, a job setter can plug his earphone into conveniently located jacks along the line and instruct the operator to shut down the equipment.

Another technique of communication, a Tel-



ELECTRONIC BALANCING of the crankshafts is a unique feature of the Lima operation. This Tinius Olsen equipment determines the angle and amount of unbalance, shifts the work to a station which drills the counterweights, again checks the work, and, if still out-of-balance, returns it for further drilling. The entire procedure is automatic.



CYLINDER BLOCKS are initially processed on this huge Cincinnati horizontal surface broaching machine. The blocks move into the machine, and after being clamped in position, the two cylinder-head surfaces and the crankcase pan surface are broached. At the end of the operation, the cylinder blocks are unclamped.

PISTON-PINS are cold extruded on this Danly press from small, solid slugs of steel. One of the newest production processes in the automotive industry, cold extrusion is fast, and offers the economy of using bar stock instead of tubing.

JOB SETTER on this transfer line can plug his telephone into a conveniently located jack to communicate with control console. The thirty-two station line, built by Natco, is 68 feet long. It processes aluminum die-cast front covers for the engines.

Autograph system, makes possible a rapid selective assembly of different engine components. As a block enters the engine assembly line, its dimensions are gaged. This information is transmitted via the TelAutograph to various plant areas, where components of matching size are then selected. These components are placed on conveyors and meet up with the block at assembly.

In the assembly area, there are five lines, each composed of thirty-one independent conveyor units tied together like links in a chain. It is possible to continue production along a line even though one segment of it may be shut down for repairs. The conveyor units are of the "power and free" overhead type, utilizing power drive units and gravity rails to move the engines through assembly. Engine blocks are carried on steel arms suspended from overhead monorail tracks.

In addition to the in-line inspection mechanisms, there are approximately 1700 different gaging applications in use. Many of these are

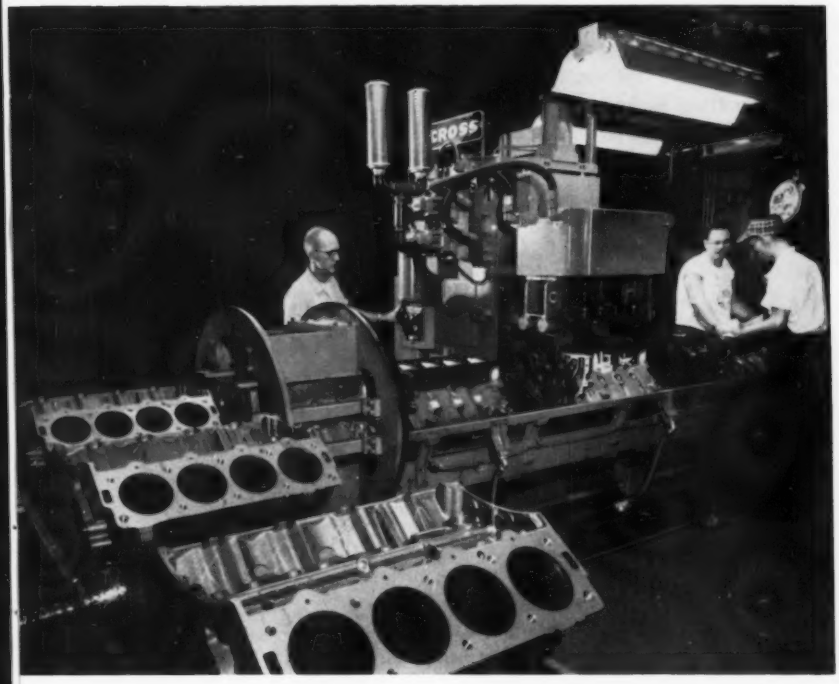
INDIVIDUALLY GRADED pistons are sent from these storage racks to assembly areas. A TelAutograph receiver notifies employes of piston grades needed for selective assembly with each cylinder block. Conveyor belt carries pistons through connecting-rod assembly on way to meet blocks.

duplicated along identical machining lines, creating several thousand separate gaging operations.

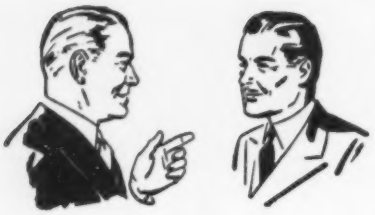
The plant's quality-control program also makes extensive use of a modern laboratory which has facilities for chemical and physical analysis of all parts and materials used. Tests are made to determine the quality of purchased materials and to check parts at various production stages until the completed engines are shipped to company assembly plants throughout the nation. Laboratory tests also are applied in placing controls on such production processes as heat-treating and plating.

A fully equipped dynamometer room is used to test engines and component parts for durability and to determine their acceptance under established standards.

Helping both management and employes to build better quality into the engines are hundreds of easily understood quality-control charts and visual aids throughout the huge plant. Numerous training programs also have been launched.



BEARING CAPS are removed from blocks by this Cross "screwdriver" at the start of the major assembly area. The caps, assembled to the blocks for a previous line-boring operation, are reassembled in order in their respective blocks after crankshafts have been installed.



Talking With Sales Managers

BERNARD LESTER
Management Consulting Engineer

Outsiders Versus Insiders

"Shall I fill this position with an outsider or an existing employe?" Again and again sales managers are baffled about reaching a decision to this question. Expansion, growing employe restlessness, and added product lines accentuate the problem. Above all, increased competition has hastened the search for men with fresh ideas and a speedier gait. In a recent instance, the equipment builder needed a man to manage the sale of a newly acquired product line. In each of two other cases there was urgent need for a man to head field sales. Two more companies were in search of men to supervise and develop sales territories.

In each case it was surprising to find that the top sales executive felt that not one of his men could measure up to the job and was charmed by some outsider. After carefully focusing on facts and circumstances, interviewing prospects, and calculating all risks, it was decided to select someone already employed to fill each position except the one requiring a product manager. Here, due to the necessity of an exact knowledge of a newly acquired product and familiarity with its market, the hiring of a stranger finally appeared wise.

Though most of us subscribe to the policy of developing and advancing old employes, we are singularly tempted to seek an answer to our sales performance prayers by picking men of "outstanding qualities" from the outside. As a result, a lot of decisions later prove disastrous, and it is pretty hard to figure the extent of loss due to injured morale and elapsed time.

New faces and forms entice us. We idealize the needs of the job to be filled. Courtship is sweet; each applicant puts forth his best qualities first and the future seems sugar-coated. Nothing illustrates this better than being rushed for a college fraternity. When a fellow finally joins he finds himself at the bottom of the heap.

In time, we readily detect the weaknesses of our old associates. On the other hand, the faults of the newcomer are much harder to detect. He naturally selects references that speak well of him.

Present employes who might consider themselves candidates for the new opening are inclined to wait, watch, and listen before the decision is made. They become vocal only when their names are cast aside and an outsider is introduced.

In a few cases we have seen the top sales executive select a stranger because he could not choose between two or three employe candidates. The problem of raising one above the other frightens him, so he rejects all. Several examples might be cited where new people are brought in at salaries so generous as to exhaust the budget for the advancement of existing employes.

In many instances the difficulty in selecting men from within the organization for advancement is the fault of present or past management. Plans and policies may be sketchy or non-existent. In-service training may be inadequate. Above all, mass supervision may displace personal supervision involving continuous and intimate contact with men. The way is not paved for any changes in responsibility and status.

Among progressive companies, you will find justifiable need for hiring outside talent in the higher brackets. Now and then, circumstances make this necessary. More frequently, the company enters a new field where particular knowledge and skills are necessary, and time is precious. Men taken from the outside need a fair break, too, for like a transplanted tree, they require both time and opportunity to establish root growth.

The problem of selecting between an outsider and an insider has overtones and undertones hard to detect at first glance. Loaded with possibilities for disappointments or rewards, it demands painstaking thought, but in the end, positive decisiveness. We asked an experienced sales executive—a man whose serenity might be mistaken for complacency—whether he didn't worry over decisions of this kind. His reply: "Yes, I worry a lot before the decision is made, but never after it. If I have done my best, I leave the rest to the gods, with me as their handy man."

Machine Tool Builders Discuss Varied Problems

THE National Machine Tool Builders' Association held its Fifty-Seventh Annual Meeting November 5 to 7, inclusive, at the Homestead Hotel, Hot Springs, Va. Various problems were discussed, ranging from the present reduced business of the industry to the machine tool exposition planned for 1960.

Alfred V. Bodine, president of the Association and president of the Bodine Corporation, Bridgeport, Conn., stated that the concept that we need prepare only for a nuclear war is seriously jeopardizing the safety of the United States.

"What assurance do we have," said Mr. Bodine, "that the next war, if any, will be a nuclear war? Do you remember back in the days before World War II when it was predicted that the next war would be fought chiefly with poison gas and germ warfare? Neither one was used. Isn't it possible that both sides would shrink from using atomic weapons in a future conflict because the result would be absolute destruction?

"To be properly prepared, we should be ready to produce at a moment's notice the requisite quantity of weapons to be used in non-nuclear warfare. This sort of production requires a good many machine tools. But the current theory is that the next war will be a twenty-minute war fought with rockets, missiles, etc., the manufacture of which does not require a large number of machine tools; and that therefore the present state of the machine tool industry is nothing to worry about. I consider this point of view very dangerous indeed."

Mr. Bodine stated that today machine tool sales are down 74 per cent from 1956, that 25,000 employes have been laid off, and that the number of machine tool companies has declined from 403 in 1952 to 367 today. Because it is increasingly hard for machines built under the high American wage scale to compete, as to price, with machines built under low wage scales prevalent abroad, more and more American machine tool builders are establishing plants in Europe. It was his belief that the machine tool capacity of the United States had shrunk below the margin of safety.

Niels A. Olsen, director of the Metalworking Equipment Division, Business & Defense Services Administration, Department of Commerce, pointed out that there is now a single point of clearance in the Government for discussing machine tool problems, expressing views on matters of public concern, obtaining first-hand information on government actions on current defense production, mobilization planning, on business services, and on all other activities affecting the machine tool industry.

Mr. Olsen mentioned that in the light of economic conditions faced by the industry during the past year, surplus disposal programs have re-

(Left) Ralph J. Kraut, newly elected president of the National Machine Tool Builders' Association; (center) Alan C. Mattison, first vice-president; and (right) Everett M. Hicks, second vice-president

ceived considerable attention. New strategic concepts and economic factors have resulted in the Department of Defense determining sizable quantities of machine tools as excess to mobilization requirements.

The Metalworking Equipment Division, in reviewing the types, sizes, age, and condition of the machine tools being declared excessive for the military needs of the Nation, concluded that many of these machine tools could properly be included in a reserve for defense-supporting production equipment during an emergency, and at the same time, could be employed by educational institutions in the training of the nation's youth. Accordingly, during April 1958, in cooperation with the Department of Health, Education, and Welfare, and the General Services Administration, the Division started to reactivate and enlarge the Federal Government's program of donating machine tools to schools. As of June 1, 1958, the over-all educational requirements were about 96,000 machine tools and about 13,000 items of related production equipment.

William E. Rutz, interim chairman of the 1960 Machine Tool Exposition Committee and executive vice-president of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., stated his belief that the exposition will be held at the psychological time for driving home to machine tool users the fact that they can regain their profit picture only through the increased productivity available through the use of machine tools developed during recent years. Mr. Rutz announced that Donald H. McIver, vice-president of industrial sales, Ex-Cell-O Corporation, Detroit, Mich., had been appointed permanent chairman of the exposition committee.

Ludlow King, executive vice-president of the Association stated that European machine tool builders are extremely alarmed about the growing capabilities of the Russian machine tool industry. It will have produced about 140,000 machine tools in 1958 and expects to increase production to 200,000 machines in 1960. He mentioned that the United States machine tool industry will build only 34,000 units this year.

Fred F. McLoughlin, factory manager of Convair, Plant 2, San Diego, Calif., discussed ways and means for closer cooperation between the aircraft and machine tool industries. Dr. Arthur R. Upgren of Macalester College spoke on economics during the next decade and Irwin H. Such, editor-in-chief of *Steel*, spoke about industrial and living conditions in Soviet Russia. Herbert E. Carson, advertising manager of the Niagara Machine & Tool Works, Buffalo, N. Y., presented awards to machine tool companies and their advertising agencies.

In the final session of the meeting, Burnham Finney, editor of *American Machinist*, presented a comprehensive paper that pointed out the thousands of machine tools in use today that are over ten and twenty years old, indicating the tremendous replacement market. This paper was followed by a panel discussion about obsolete machine replacement.

Ralph J. Kraut, president of the Giddings & Lewis Machine Tool Co., was elected president of the Association for the coming year. Alan C. Mattison, president, Mattison Machine Works, Rockford, Ill., was elected first vice-president; and Everett M. Hicks, vice-president and general manager, Grinding Machine Division of the Norton Co., Worcester, Mass., was elected second vice-president. Graham E. Marx, vice-president and general manager, the G. A. Gray Co., Cincinnati, Ohio, was re-elected treasurer. Walter K. Bailey, president of the Warner & Swasey Co., Cleveland, Ohio, was re-elected secretary of the Association.

New directors elected were Mr. Hicks; James K. Fulks, executive vice-president, Ex-Cell-O Corporation, Detroit, Mich.; and Grayson M. Stickell, president and general manager, Landis Machine Co., Waynesboro, Pa. Ludlow King was re-elected executive vice-president.

(Left to right) Graham E. Marx, treasurer of the Association; Walter K. Bailey, secretary; and James K. Fulks and Grayson M. Stickell, new directors

Machine Tool Distributors Improve Selling Techniques

THE past year's recession was a "breathing spell" which was used to advantage by distributors, according to Frank H. Habicht, president of the American Machine Tool Distributors' Association. Speaking before 400 members and guests at the Association's Thirty-Fourth Annual Meeting at the Sheraton Plaza Hotel in Boston, on October 16, he said, "During the past year, we have seen harder selling. Distributors all over the country are proving that selling is really not a lost art."

J. O. Ellison, newly elected president of the American Machine Tool Distributors' Association

Habicht told the meeting that his visits to distributors throughout the country showed that members were expanding sales coverage, advertising, and public relations work. At the same time, reduction of unnecessary costs has increased efficiency. He also emphasized that "the intense competition during this breathing spell has served to point out the need for more advanced engineering and development work in many areas. We must accelerate our engineering to be sure that the American machine tool industry remains ahead of the world in technology," Mr. Habicht said, "so we can adequately compete in the export markets as well as in our own market at home."

Commenting on his recent visit to European machine tool plants and to study Soviet-Bloc machine tools exhibited at the Brussels Fair, Mr. Habicht said, "Our complacent attitude of the past—that the U. S. machine tool industry has no real competition from the Iron Curtain countries—is in for a rude shock."

Confirming progress in the "hard sell" program of distributors, James C. Kelley, general manager of the Association stated, "Distributors have increased their percentage of total new machine tool business during the first eight months of 1958 by more than 20 per cent over 1957."

Kelley also stressed the importance of finding adequate numbers of well-trained sales engineers to meet the expanding needs of distributors. He urged an all-out attack by distributors to meet the competition from other industries offering what appears to be a more glamorous career. "We must encourage more men to look at the machine tool industry for their career," Mr. Kelley said. He also announced the Association plans for a Manpower Placement Service to help funnel available manpower into the industry.

R. W. Nissen, chairman of the Association's Overhead Expense Research Committee, told the meeting, "We have a real job of selling the value of the selling effort." He said, "We have been building up an insidious philosophy in this country that only manufacturing adds value to goods. We as builders and distributors must make it clear that this business of selling and servicing a machine tool is part and parcel of the value as well as the cost of a machine."

Citing the increasing services performed by distributors in the face of a 27 per cent decline in net profits, Nissen urged distributors to use better management tools to determine where they can better utilize their time—"to concentrate on lines which produce a reasonable return on investment, and inject more efficiency into operations."

"Small business has become a kind of rallying point for groups that could agree on nothing else," George E. Merryweather, chairman of the Association's Government Relations Committee, told the meeting. "There was a time in this country when the canal companies got about what they needed," he said. "Then came the railroads and the farmer. In the 1930's it was labor—and it still is labor to a large extent." Mr. Merryweather predicted a continuation of the small-business trend, and a considerable increase in benefits available to alert small businessmen.

Joel Barlow, prominent Washington attorney and counsel for the machine tool industry, told

Other new officers of the AMTDA are (left to right) J. Russell Clark, first vice-president; George E. Merryweather, second vice-president; and I. B. Rabel, secretary-treasurer

the meeting, "Although the politicians are doing little or nothing to solve industry problems, the fault lies not so much with them but with the inability of businessmen to get the support of the politicians and the public understanding of the real issues involved."

Barlow stated, "Our Government's unrealistic and unwise tax depreciation policy has been one of the principal factors in the slowdown in our economy. Business simply cannot expand or even replace and modernize its facilities if there is little or no prospect of recouping its investment out of profits."

"Only in periods of fair and reasonable depreciation policies has this or any other nation moved ahead industrially," Barlow declared. "Today the other principal industrial nations of the world have adopted realistic depreciation policies and they are moving ahead.

Mr. Barlow emphasized that "to those misguided few who think we have enough facilities, and that the slowdown is due to overexpansion of productive facilities, the answer is easy. No nation or economy has enough modern labor-saving and cost-reducing facilities." "Any so-called overexpansion is directly attributable to the continued use of obsolete, high-cost machinery," he claimed, "and this machinery continues to be used because with unrealistic depreciation policies and confiscatory tax rates the cost of new facilities is prohibitive."

In commenting on recent legislation Mr. Barlow said, "Congress in the last session made it perfectly clear that they recognize the problem but they also went home in August without doing anything really effective about it. Recognizing the inadequacy of depreciation allowances, they made a gesture toward a change by adopting what may be described as only a token $2000 additional depreciation allowance. This will help some people a little, but no one enough to make even a dent in the problem," he said.

Gear Manufacturers Hold Semi-Annual Meeting

The first meeting of the American Gear Manufacturers Association since the adoption of new by-laws in May of this year was held October 26 to 29, inclusive, at the Edgewater Beach Hotel, Chicago, Ill. There was a marked change in the program, certain committee meetings being open only to members of the product group and members of the specific committees. Meetings of the technical division, however, were open to all members.

There were a total of thirty committee meetings which dealt with engineering, manufacturing, and merchandising problems. In addition, there were several joint sessions, at one of which George W. Michalec, of the General Precision Laboratory, Inc., presented a comprehensive paper entitled "Analysis and Comparison of Total Composite Error and Position Error in Gears."

John A. Bradner, president of the Lees-Bradner Co., made a luncheon address titled "Search for Silence." In this talk Mr. Bradner traced the history of gearing from the early concepts of Aristotle down to the present era. He discussed types of gears and manufacturing practices.

Richard E. Hoppe, Minneapolis-Honeywell Regulator Co., gave an illustrated talk on the subject of training and methods of keeping professional employes.

Modern Facilities for Making Fasteners

HEX-SOCKET, cap- and set-screws, and related products, are now being produced by the Allen Mfg. Co. in an ultra-modern plant at Bloomfield, Conn. The new plant comprises a 250,000 square-foot, single-story factory section, and a 20,000 square-foot, two-story office building. Careful planning has gone into the design to insure the efficient production of high-quality products and to permit substantial future expansion. Included is a 10,000 square-foot pilot plant in which new machines, materials, and manufacturing processes will be tested prior to use in production.

One of the outstanding features of the plant is a new concept for handling and storing bar and rod stock, which minimizes space and manpower requirements. Bundles of stock, 12 feet long and weighing up to 6000 pounds, are stored in "Christmas-tree" racks having a total capacity of more than 4,500,000 pounds. A special stacker crane, operated by and carrying only one man, can be moved freely down any aisle between the racks, and up and down to any level.

Bar and rod stock removed from the storage racks is transported to an adjoining manufacturing area. Here, depending on the size and volume of the products to be made, the material is placed on cold- or hot-headers, or on automatic screw machines. A partial view of the screw machine division is seen in Fig. 1. The largest cold-header is a Waterbury Farrel, five-station, progressive machine, equipped with an Ajax-Hogue wire-drawing unit, for producing socket screws up to 7/8 inch in size. The material is automatically cut off, coned, headed, extruded, and drawn at successive stations on this machine. For hot-heading on an Ajax 2 1/2-inch diameter capacity machine, the stock is raised to a temperature of 1800 degrees F. by means of Westinghouse induction heating units.

Secondary machining operations performed—depending on the product—include thread rolling, knurling, pointing, shaving, and centerless grinding. The threads on some screws are ground to Class 3A and special fits. Coolants used on these machines are kept clean by means of magnetic separators. Also, a clean working atmosphere is maintained by Westinghouse Precipitron electrostatic air-cleaning units, which dissipate the mist generated by the oil during high-speed operation.

All of the products are washed after each proc-

Fig. 1. A portion of the automatic screw machines used for producing hex-socket, cap- and set-screws from bar and rod stock.

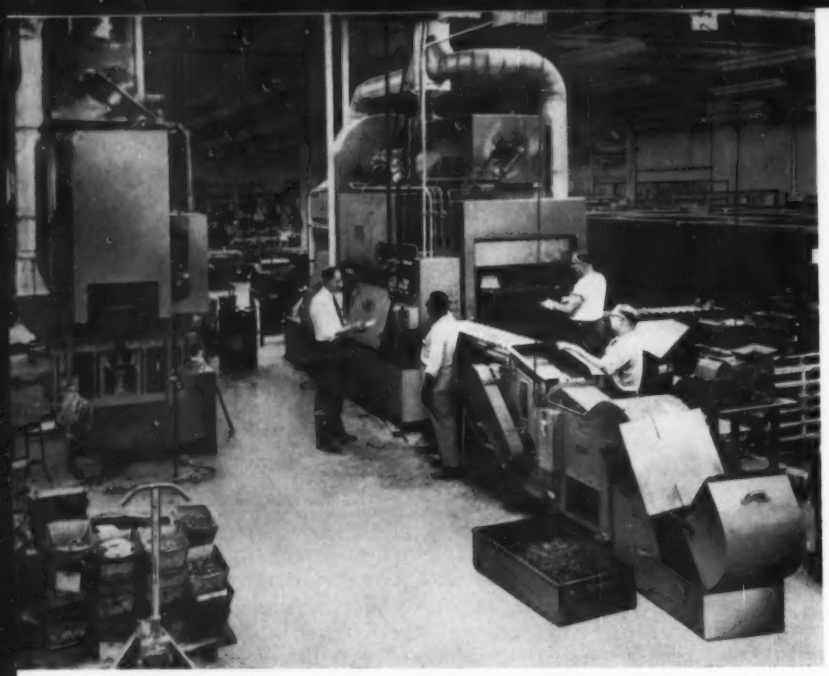


Fig. 2. Special washing machines employed to remove abrasive materials and contaminants from products after each operation and before heat-treatment.

essing operation and before heat-treating to remove abrasive materials and contaminants. The special washing machines employed, Fig. 2, can be operated by one man, since loading and unloading are performed from the same station. In the foreground at the right is a vibrating unit which removes metal particles that may adhere to the products.

Included in the heat-treating department are Holcroft units that harden, quench, wash, and temper the parts in a continuous, automatic operation. Also, a new AGF rotary furnace has been provided for carburizing dowels.

While quality has always been stressed in the production of dependable fasteners at Allen, the Quality-Control Division has been greatly expanded at the new plant. Incoming material, in-process work, and finished parts are all carefully scrutinized and tested. For example, Jones & Lamson optical comparators are used to inspect thread forms and leads. A gage control section has been provided to test the accuracy of all gages within extremely close tolerances.

Equipment in the metallurgical laboratory includes two Riehle stress-rupture testing machines, Fig. 3, for determining the rupture life of screws under varying conditions of temperature and load. Temperatures in the furnaces at the right are normally between 300 and 1200 degrees F. but can be raised to 1800 degrees F. for testing the strength of high-temperature materials. Also included in the laboratory are two Tinius Olsen tensile testing machines—one of 440,000 pounds capacity and one of 60,000 pounds capacity.

A Tinius Olsen torsion testing machine of 120,000 inch-pounds capacity is currently being installed. A special room is devoted to metallographic studies of the microstructure of both raw materials and finished products. The American Optical Co. instrument used for this work is capable of 1500 times magnification. In another special room, fatigue tests are run on screws with Baldwin-Lima-Hamilton testing equipment.

Fig. 3. Rupture life of screws is tested under varying conditions with this setup. Parts can be heated to between 300 and 1800 degrees F.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Enlarging Tool Speeds Layout of Master Cams

RALPH T. STEWART, Winston-Salem, N. C.

Designers of automatic machinery will appreciate this time-saving layout tool which eliminates hours of work when it becomes necessary to enlarge cams. It is commonly the case that an oversize master cam, to be used on a cam-cutting machine, must be made up from a full-scale cam drawing. With the illustrated tool, the enlargement can be laid out directly from the original drawing without depending on radial lines or resorting to the use of a compass.

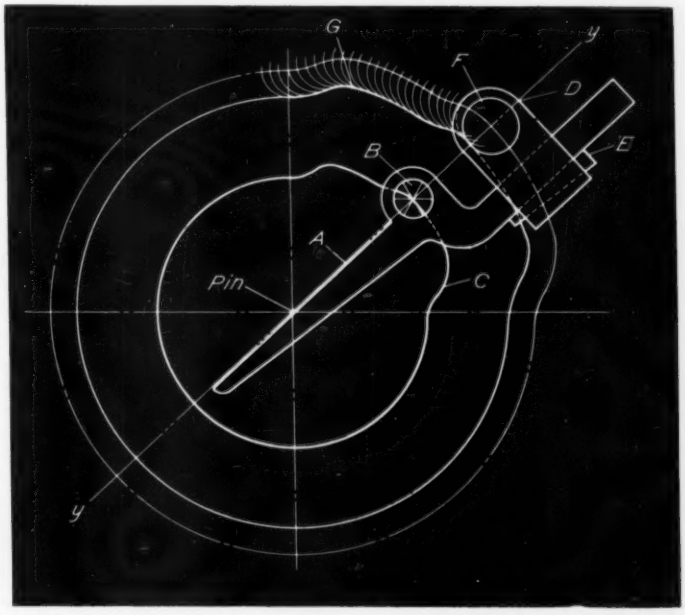
The body of the layout tool should be made of either aluminum or stainless steel. Edge *A* of the lower end of the tool is absolutely straight and rests on line Y-Y, which passes through the center of the cam to be reproduced. This edge is maintained in alignment by holding it in contact with a pin placed at the center point of the cam drawing.

A clear plastic marker *B* is inserted in a hole at the upper end of edge *A*. Six equally spaced radial lines are provided across the face of the marker —their point of intersection falling on line Y-Y. It is this point that is used to sight and follow contour line *C*, representing the path to be traced by the center line of the follower-roller.

Adjustable head *D* slides on the offset upper end of the layout tool. The head can be locked to the tool at any point within its range of movement by means of wedge *E*. Positioning of the head determines the degree of cam enlargement that will be obtained.

A 2-inch hole *F* in the adjustable head serves as a guide for tracing the outline of the roller to be used on the cam-cutting machine. The center of this hole is located exactly on line Y-Y, thus assuring an accurate mathematical relationship between locating edge *A*, marker *B*, and the roller outline traced through hole *F*.

Reducing inserts can be made up to permit the tracing of circles representing smaller-size rollers. The inserts should have a 2-inch outside diameter to fit in the original hole, and an inside diameter machined to suit the roller on the cam-cutting machine. A suggested assortment of reducing inserts would include the following sizes: 1 3/4, 1 1/2, 1 1/4, and 1 inch. It is advisable to have the inside diameter approximately 1/32 inch oversize to compensate for the pencil line. The enlarged cam outline *G* is plotted in the usual way, that is, by a line connecting the series of traced circles.



Layout tool permits rapid and accurate enlarging of cam drawings. It is especially useful when large master cams must be made to guide cam-cutting machines.

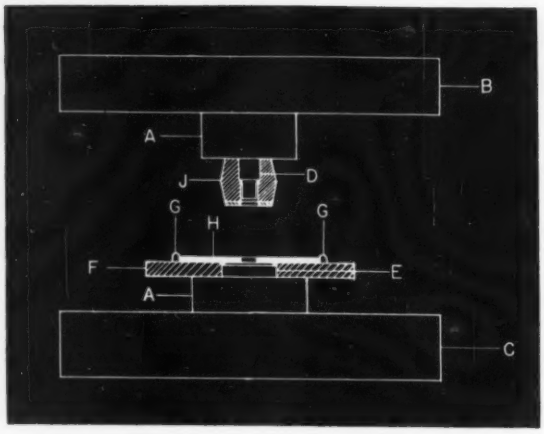
Combined Template and Work Nest for Short-Run Piercing

BUCKLEY SULLIVAN, Shaker Heights, Ohio

A simple template, used with standard punches and dies, provides an economical hole-piercing means for a shop specializing in short runs of experimental stampings. Since the template also forms a nest for the work, no elaborate setup is required.

The drawing shows a typical arrangement. Retainers *A* are attached to the punch-holder *B* and the die-shoe *C*. Punch *D* and its die *E* are accommodated in their respective retainers. Template *F*, made of 1/4-inch steel plate, is bored out in the piercing area to correspond to the outside diameter of the die, and rests on the die retainer. Previously, pins *G* have been pressed into the template at appropriate points to form a nest for locating stamping *H*. Rubber stripper *J* is fitted around the punch.

Round, square, and oblong punches and dies are available commercially in a range of sizes. Dimensions of punch shank and die periphery are the same for several sizes, making them interchangeable in the same retainers. However, it is important that the dies used protrude from their retainer a distance equal to the thickness of the template, plus about 0.030 inch for regrinding.



The template is bored to fit over the die and rest on the die retainer. Pins in the top of the template form a nest for the stamping.

Die with Arrangement for Immobilizing Punches

W. M. HALLIDAY, Southport, England

A multiple-piercing die that incorporates a simple and time-saving device for inactivating one or more punches is here illustrated. The press need not be shut down for more than one or two minutes and the die does not have to be dismantled. While the arrangement shown is designed for use on a die having four punches, the principle may be applied to tools with a different number of punches and a varied pattern of holes.

Operating simultaneously on a previously blanked-out steel work-piece, the four punches differ only slightly in size on both their working ends and shank diameters. Their length to diameter ratio is high; thus they distort or fracture easily. Although located at slightly different radial and chordal spacings apart, these punches are all situated fairly close together. The finished pierced blankings, in this case, had to be made in sets of two, one part having four holes and the other having three. In production, after half of the components were pierced with four holes, one punch was immobilized and the remaining components were pierced with three holes.

Referring to the diagram, the three punches *A* and punch *B* are of the standard, headed type. Their cylindrical shanks are ground to be a close sliding fit within guide holes provided in the hardened steel punch-plate *C*. The head of each punch is located in a counterbore in the top of plate *C*—the depth of the counterbore being equal to that of the punch heads. Part *D* is a hardened-steel spacer plate of the same shape and over-all dimensions as plate *C*, except for its thickness, which is somewhat greater. Plate *D* has a centralizing shoulder on the top which fits into a bore in the bottom of the adjacent punch-holder *E*. All three components are retained permanently together by cap-screws *F* and dowels. The punch-holder has a standard cylindrical shank for mounting the tool in the press ram.

Projecting a considerable distance from the bottom of plate *C*, the punches are guided in a stationary stripper plate *G*. They do not pass completely out of the stripper plate when the press ram is at its highest point, as shown at *x* in the illustration. For clarity, the stripper plate is eliminated in the bottom view.

A blind hole is bored into the bottom of spacer plate *D*. The diameter of this hole is considerably larger than the greatest distance measured diametrically over the outer surfaces of two opposed

punch-heads and the depth is about three-quarters of the thickness of plate *D*. However, this depth is largely determined by the amount of lift required to make the punch inactive. The end face of the hole is finished flat and smooth. Hardened-steel disc *H* is ground to fit closely and revolve in this hole when the other plates are fastened in position by screws *F*.

A rigid backing is provided for the operating punches as their heads bear against the ground under side of the disc. The construction of the disc also permits punch *B* to be raised and retained in an inoperative position.

A hole *J* with a diameter about 1/8 inch larger than that of the punch-head is bored through disc *H*. This hole is located on the same pitch circle as punch *B*. T-slot *K* extends in an arc along this same pitch circle to the right of hole *J*. The width of the lower portion of this T-slot is somewhat greater than the shank diameter of the punch. The height of the narrow section of the T-slot, as measured from the bottom of the disc, is equivalent to the amount of lift required to prevent the punch from piercing the work-piece when the press ram is at its lowest point. The side walls of the T-slot above this lift-height are widened to equal the diameter of hole *J* in order to provide clearance for the punch-head. Punch *B* may then pass through this slot with the head supported by the shoulder surfaces. Hole *J* and its adjoining T-slot *K* are shown by broken lines in the diagram.

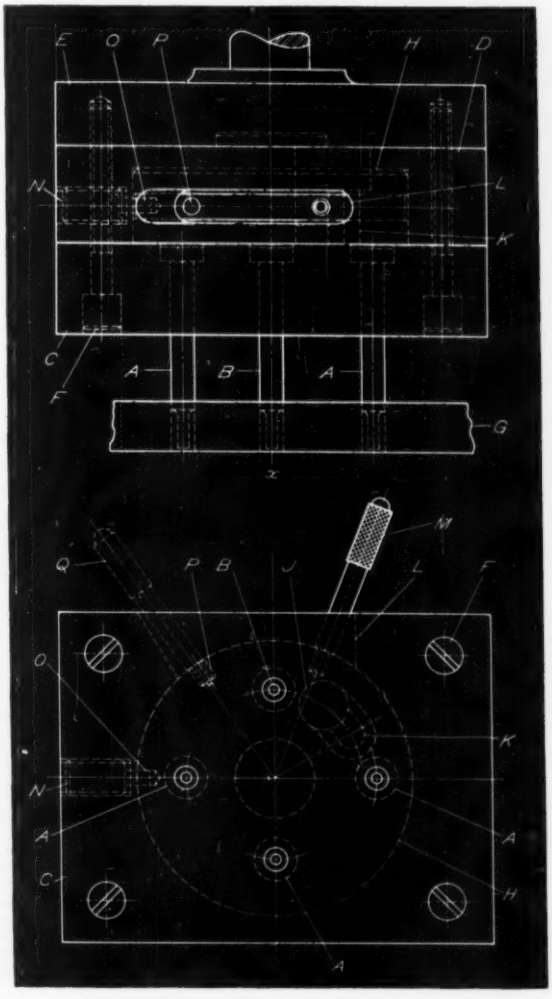
The movement of the disc is accomplished by the following arrangement. Slot *L* is cut into the front of spacer plate *D* so as to enter the disc bearing hole. The slot is located centrally in the depth of the hole and exposes a considerable portion of the disc periphery. A detachable operating handle *M* passes through this slot to screw into a tapped hole in the rim of the disc. The length of slot *L* is determined by the amount of circular movement required for the disc, and its width is slightly larger than the handle diameter.

The illustration shows disc *H* in the position that allows all four punches to be active. Note that the disc gives solid back support to each punch. Set-screw *N* retains the disc in this setting. This set-screw threads into a tapped hole in spacer block *D* with the dog-end fitting into a blind hole *O* in the disc. When the tool is operating with the disc in this position, handle *M* is removed.

A second blind hole *P*, identical in size with hole *O*, is also drilled into the disc rim the necessary distance away. This hole is used to secure the disc in position when the punch *B* is immobilized. When the disc is in this latter position, handle *M* is in position *Q*, shown dotted at the left.

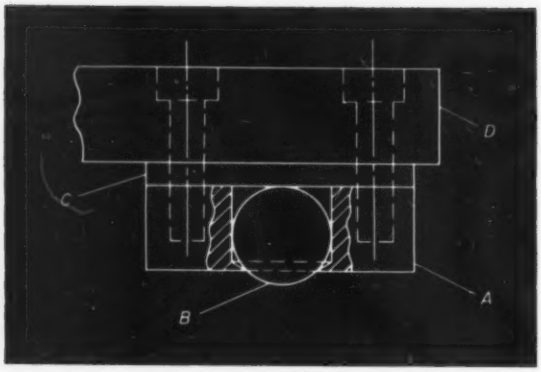
Adjustment of disc *H*, to retract punch *B*, is quickly accomplished. It is only necessary to slacken screw *N* a few turns, insert handle *M* into the disc, and move it to the left until the punch can be raised into hole *J*. Then, by moving the handle a little further to left, the punch head is retained in this raised position by the shoulders of T-slot *K*. Finally, screw *N* is tightened into place in hole *P* to secure the disc. These operations can be rapidly performed while the tool is in the press without dismantling any of the parts.

Where it is necessary for more than one punch to be immobilized, additional hole and slot formations may be provided in the disc *H* at the appropriate points. Extra locating holes for screw *N* should also be provided.



Punch (B) can be easily inactivated by retracting it into disc (H). Turning the disc locks the punch in circular T-slot (K). For clarity, stripper plate (G) is not shown in bottom view.

SHOP KINKS



Simple design for ball-bearing jig feet.

Anti-Friction Drill Jig Feet

FRED BARKER, Ilion, N. Y.

When drill jigs are slid along the table of a drill press, the resulting friction causes wear of the jig feet and, indirectly, fatigues the machine operator. Both of these conditions can be greatly reduced by installing ball-bearing feet of the type here illustrated.

Retaining block *A* is drilled slightly larger in diameter than ball *B* and deep enough to allow it to roll freely. By drilling no deeper than necessary, the seat that is formed prevents the ball from dropping out when the jig is turned over. Wear plate *C* is hardened and ground and the assembly is secured to the drill-jig body *D* by two socket-head cap-screws.

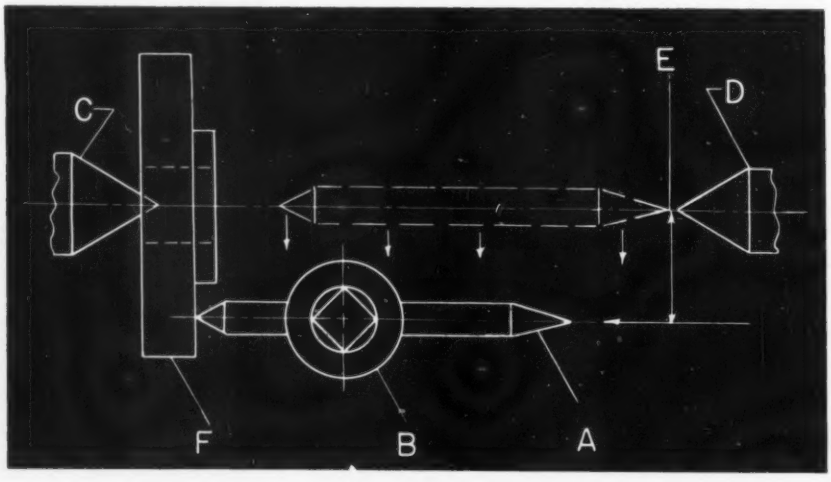
Lathe Scribing of Bolt Circles

FRANK L. RUSH, Woodbourne, N. Y.

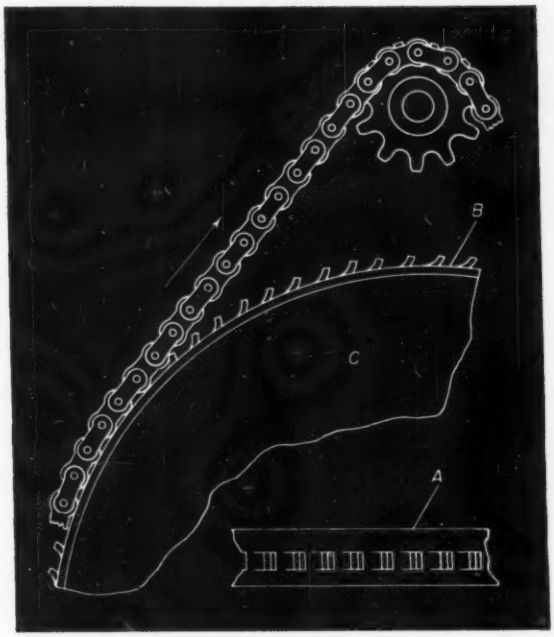
A work-piece such as a flange or a flat plate that is checked in a lathe often requires a circle of bolt holes to be drilled in a subsequent operation. If the center of the pitch circle for these holes coincides with a bore in the part, layout of the bolt circle can be facilitated by the method here illustrated.

A double-ended scriber *A* is machined from drill rod and then hardened and tempered. The pointed, conical ends of this tool are ground to an included angle of 60 degrees at the scribing end and an included angle of 30 degrees at the other.

Normally, the scriber is clamped into the lathe toolpost *B* and lined up with headstock center *C*. In applications where the headstock center is inaccessible, the entire tool is aligned with the axis of the lathe. Tailstock center *D* and a bore concentric with bolt circle are useful for this purpose. After being correctly centered the scriber is moved by means of the lathe cross-slide a distance *E* equal to the radius of the bolt circle. Graduations on the cross-feed dial allow accurate positioning of the scriber. Any backlash should be nullified by turning the cross-feed screw in one direction only. Once in position, the lathe spindle is engaged and the scriber is brought up to the face of the rotating work-piece *F* to accurately lay out the bolt circle. The centers of the holes to be drilled can then be marked in the conventional manner.



Scriber used to lay out bolt circles on a work-piece that must be chucked in a lathe for an operation previous to drilling.



Light-duty sprocket has stamped teeth for one-way rotation.

Inexpensive Light-Duty Sprockets

CLINT MCLAUGHLIN, Rockaway, N. Y.

When a large number of light-duty chain drives are to be made for intermittent operation in only one direction, the larger, driven sprocket may sometimes be produced inexpensively in the manner here illustrated. The teeth, shaped as shown, are stamped into strip stock. After the toothed stamping *A* is cut to length, it is rolled into a ring *B* and the ends are welded. The ring is then welded to the face or periphery of a plate *C* which, in turn, is welded to a hub. This completes the unusual sprocket. Although the individual teeth are not as strong as those on conventional sprockets, there are generally enough teeth of the driving sprocket in contact with the chain to provide an ample one-direction drive for light-duty applications.

Lightweight Length Gages

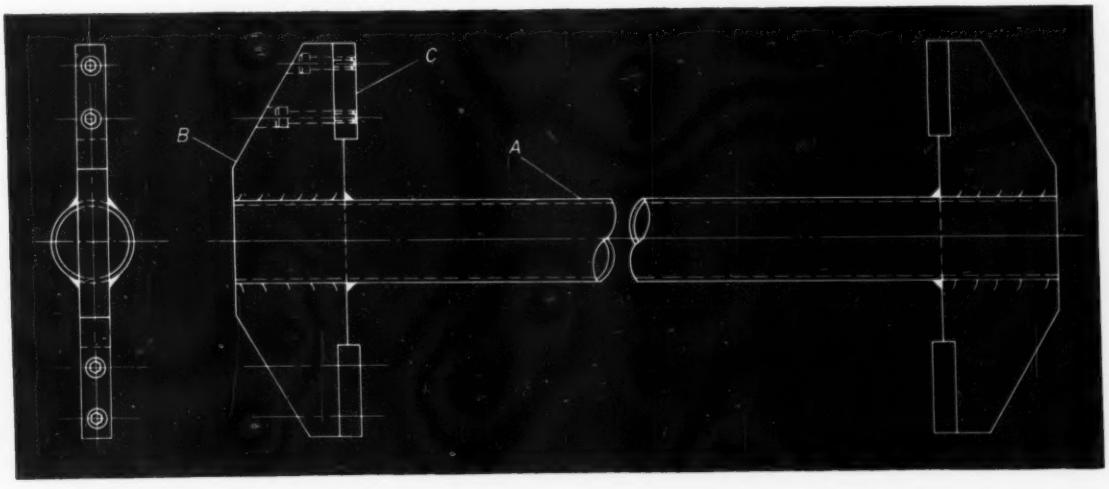
ROGER ISETTS, Kenosha, Wis.

When the length of extremely long work-pieces has to be accurately checked, gage weight often becomes a problem. If the gage is made from solid stock, it will not only be unnecessarily heavy and cumbersome to use but the cost of making it will, in most cases, be excessive. A simple, yet inexpensive method of fabricating such length gages is here illustrated.

A length of thin-walled tubing *A* is used for the gage body. Slots are milled in both ends of the tubing and cross-pieces *B* are inserted and welded in place as shown. The cross-pieces are then finish-machined to accept hardened and ground gaging strips *C* which are bolted in place to obtain the "Go" and "Not Go" dimensions. If these strips wear beyond part tolerance after continued use, or an engineering change is made, it is a simple matter either to install shims, grind more metal off, or make new ones.

A gage designed in this manner is relatively light but is still rigid enough to take normal shop abuse.

Long-length gage having body of lightweight tubing to facilitate handling and reduce cost.



LATEST DEVELOPMENTS

Machine tools, unit mechanisms, machine parts and

Giant-Size G&L Horizontal Boring, Drilling, and Milling Machines for High Work

A series of giant-size, extra-heavy, horizontal boring, drilling, and milling machines with provisions for more than twenty feet of vertical headstock travel has been announced by Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. The machines in this new 80 series have been designed for precision heavy drilling, large hole boring, and heavy milling on huge work-pieces. They have 8- or 10-inch diameter spindles and main-drive motors up to 100 hp. The four basic models include floor type, floor type with underarm, floor type with cross-sliding column, and planer type machines. The Model 880-FUAR floor type with an underarm is illustrated in Fig. 1.

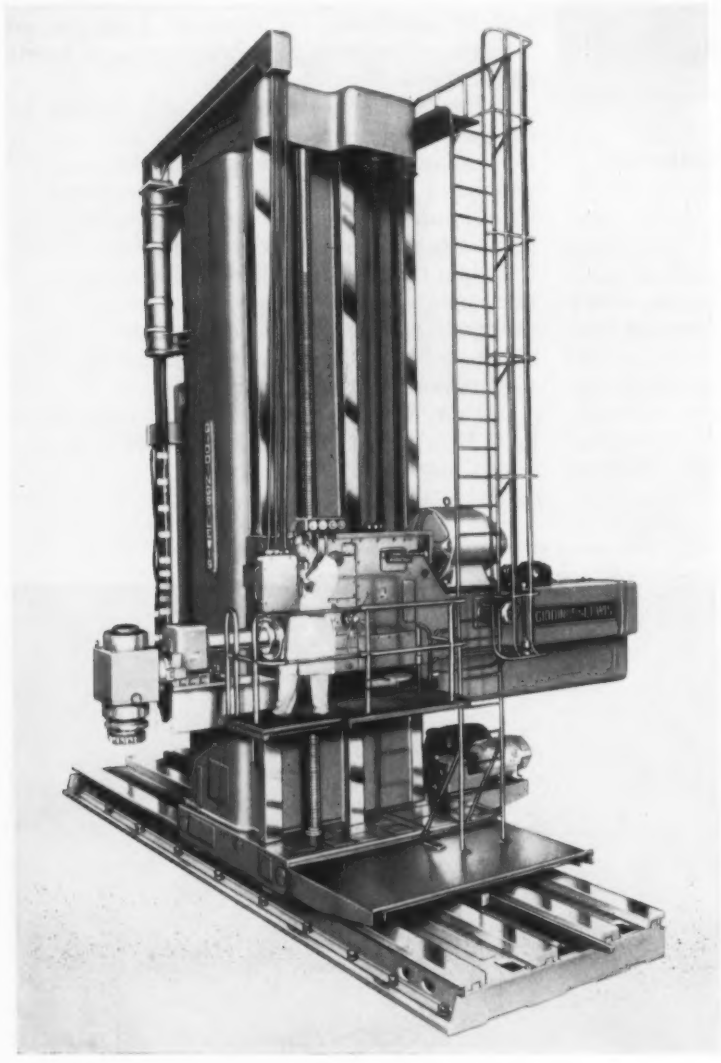


Fig. 1. Giddings & Lewis Model 880-FUAR boring, drilling, and milling machine with underarm

The line of 80 series machines has also been arranged for adaptation of programmed controls including template tracer, numerical positioning, and numerical contouring. Under numerical operation the machine will be controlled from either punched paper tape or magnetic tape.

These machines utilize an extra-heavy, specially reinforced, three-way, welded steel column. This patented feature serves to provide the rigidity necessary for precision work with a headstock travel of over 20 feet. Also of precision weldment construction are the machine headstock and column base.

The 80 series features complete remote control from a swinging pendent station, Fig. 2. This pendent provides pre-selection of all speeds and feeds and selection, engagement, and clamping of all moving units. Push-button positioning of all units is also included in the pendent control. A portable station controlling all spindle functions is provided for use where the size of the work-piece might inhibit the use of the swinging pendent.

Exceptional versatility and adaptability to difficult machining operations are claimed for the

IN SHOP EQUIPMENT

material-handling appliances recently introduced Edited by Freeman C. Duston

underarm arrangement. The underarm is a 16-inch-square steel weldment with a total travel of 84 inches. It extends the working range of the machine by carrying such available accessories as a 90-degree angular-milling attachment, anti-friction spindle support, continuous-feed facing head, shaping attachment, or a 62-inch diameter faceplate drive. Fig. 3 shows the new Model 880-FUAR machine equipped with special continuous-feed boring and facing tool for use on a faceplate drive. It permits handling of work normally routed to large vertical boring mills. This machine and tooling was recently built to bore, turn, and face atomic-reactor housings 30 feet long having flanges up to 150 inches in diameter.

An exclusive G & L development of the 80 series machine is an electronic readout system which provides measurement of machine motions at the pendent station. This offers the operator a much simpler and faster means of positioning or measuring machine motions than is possible with the scales and verniers. Direct-reading odometer type dials are mounted in the pendent station. Measurements of the headstock or column position are read in digital figures to within 0.001 inch through a servo system which translates all movements up, down, forward, or backward from a given reference point. This point can be changed at will to orient the machine to the work-piece at any position in its full length of travel. These measuring units are also available for spindle and underarm in-and-out travel.

Infinitely variable control with direct-reading meters for all speeds and feeds is another design feature of the new machines. The spindle-driving motor, as well as the individual feed motors for the headstock and column, are operated on 230-volt direct current and have a 4 to 1 ratio, adjustable speed range. This provides infinitely adjustable speeds between 2 and 500 rpm and infinitely adjustable feeds between 0.5 and 120 inches per minute.

The 96-inch-wide base runway is provided with four flame-hardened and ground bearing ways. As further protection, the bearing surfaces on the headstock and column base are lined with a non-metallic material and provided with an automatic lubrication system.

Other features include: telescopic sights for headstock, underarm, and column travel; two-way telescoping operator's platform or independently powered, elevating,

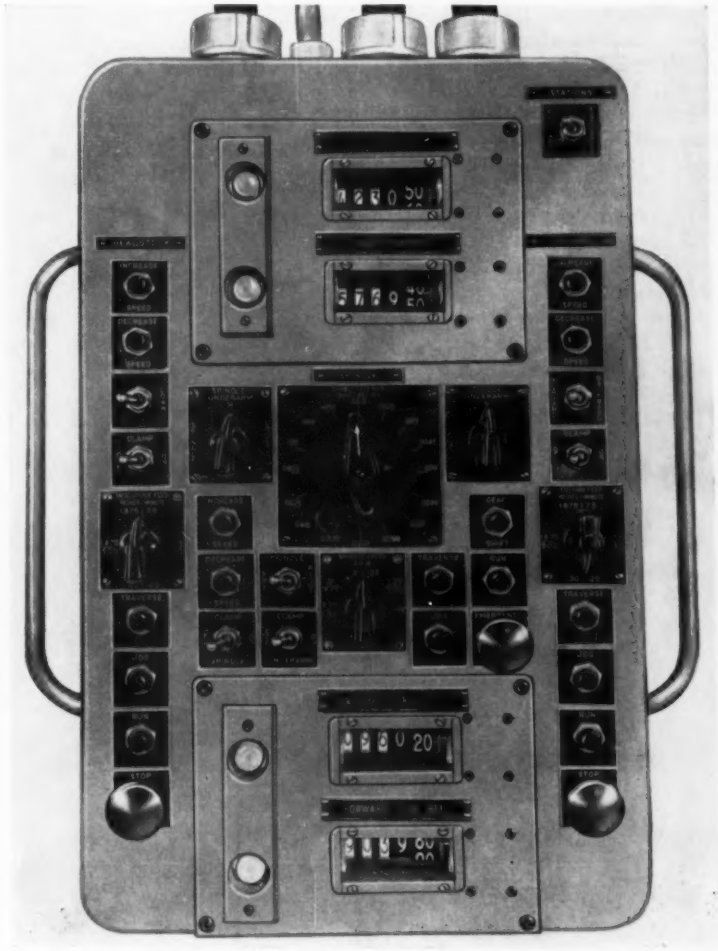


Fig. 2. Pendent control station designed for use on machines of model illustrated in Fig. 1

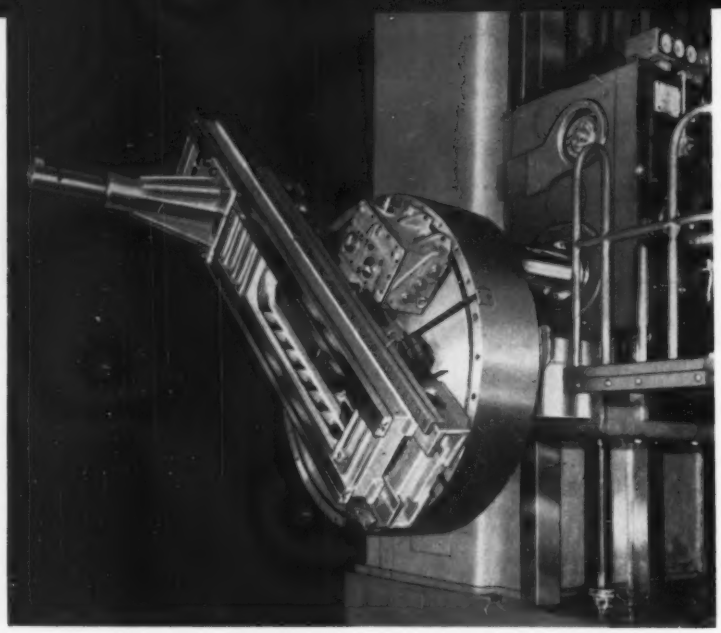


Fig. 3. Model 880-FUAR machine equipped with special continuous-feed boring and facing tool for use on a faceplate drive

operator's platform; spindle-depth counter and micrometer dial; counterbalanced pendent; spindle handwheel for tapping; separate spindle and underarm traverse motor; and electro-hydraulic clamping throughout. A built-in, thread lead device can be provided.

Circle Item 565 on postcard, page 219

BarnesdriL Vertical Type Honing Machines

Two BarnesdriL Model No. 320, standard vertical type honing machines have been built by the Barnes Drill Co., Rockford, Ill., for honing the bores of two different cast-iron V-8 cylinder blocks for truck engines. The bore sizes are 3.625 inches in diameter by 5 11/16 inches long and 3.875 inches in diameter by 6 1/4 inches long in respective parts. Both sizes are semi-blind-end bores. The two honing machines are placed side by side and connected by a synchronized automatic trunnion and transfer type fixture, also of BarnesdriL design. This completely assembled equipment is fully automatic and has electrical interlocks and probe.

While the equipment is in operation, the attendant's only duty is to replace worn-out honing stones as directed by signal lights on the control panel and also to move the parts manually on the conveyor approximately one part length into the pre-loading station. A sensing device in the pre-loading station detects the presence of a part and starts the automatic work cycle of transfer, load, clamp, trunnion, hone, return trunnion, and unclamp.

The cylinder block placed in the pre-loading first station is moved into the fixture at the second station by a transfer bar. The part is located in the fixture by pins that engage dowel holes in the pan face. The positioned part is then hydraulically clamped and rotated to place the left bank of bores vertically in the honing position. Simultaneously, a part in the fifth station has been rotated in the opposite direction to locate the right bank of bores in a vertical position for honing.

During normal operation, there are six blocks in the machine; one in the pre-loading first station; one in each fixture (second and fifth stations); one each in the third and fourth idle stations between the fixtures; and one in the sixth ejecting station.

Each honing machine has an automatic bore-sizing device, 20-inch, hydraulic spindle stroke, and one four-spindle auxiliary head. The heads are arranged with pneumatic hone expansion which features automatic rapid expansion and collapse and automatic compensation for stone wear.

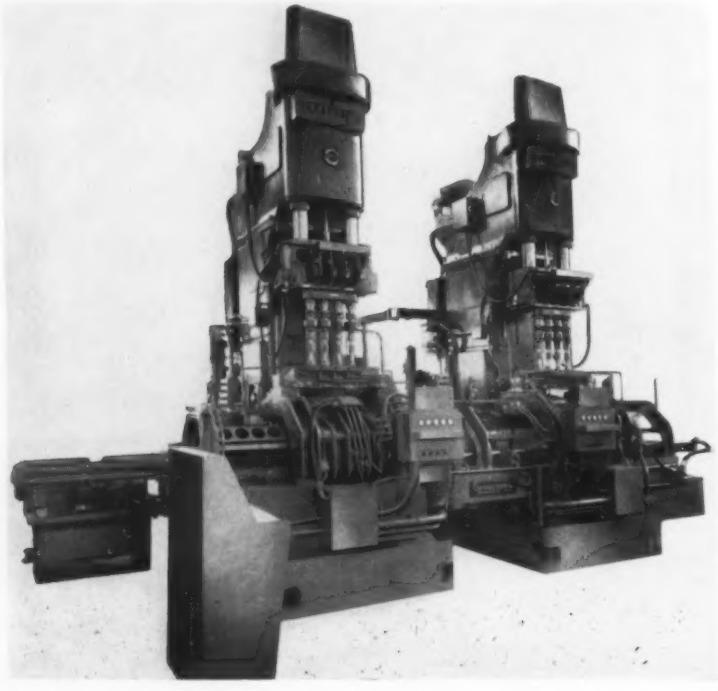


Fig. 1. Front view of BarnesdriL honing machines equipped for production honing of bores in V-8 cylinder blocks

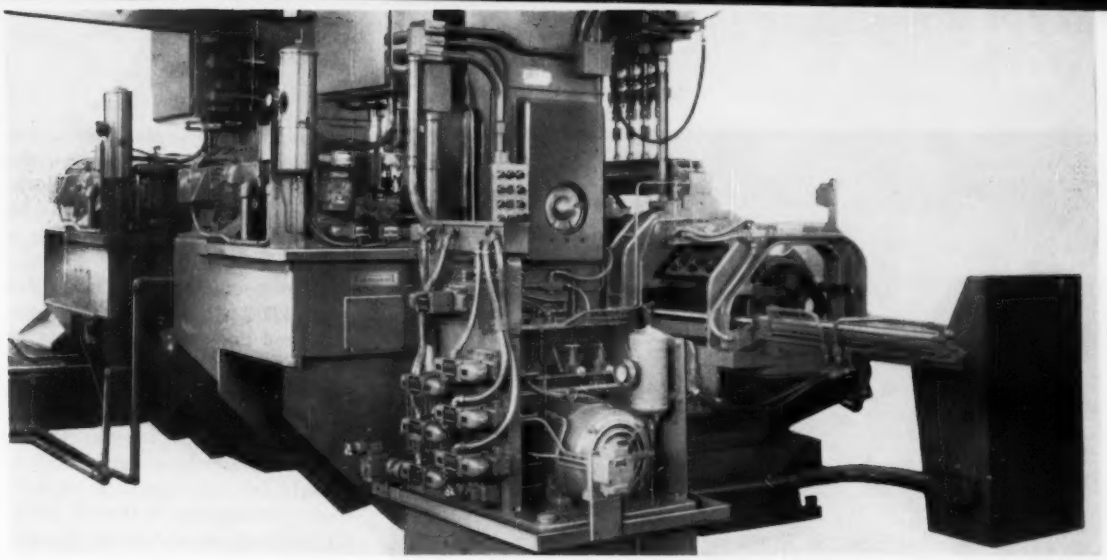


Fig. 2. Rear view of honing machines shown in Fig. 1

Pneumatic hone expansion and the proper stone selection facilitates the removal of 0.004 to 0.005 inch of stock from the bores in less than thirty seconds. Prior to honing, the cylinder blocks are reamed with an eight-blade cutting tool which leaves 0.004 to 0.005 inch of stock to be removed by the honing operation. The production rate is eighty-five blocks per hour, gross, and sixty-eight parts per hour at 80 per cent efficiency.

Bore sizes, after honing, are consistently within 0.0005 inch from bore to bore of the specified diameters and geometrically accurate within 0.0005 inch for taper and 0.0005 inch for out-of-roundness. Surface finish is 35 rms.

Circle Item 566 on postcard, page 219

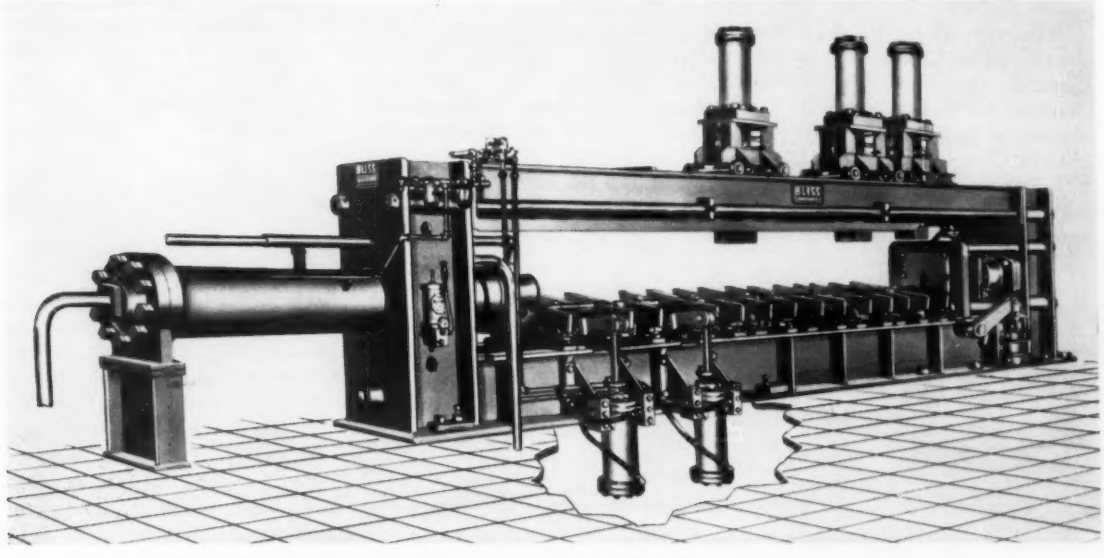
Bliss Billet Centering Press

A hydraulic press designed to accurately center billets prior to piercing in the production of steel tubing has been developed by the E. W. Bliss Co., Canton, Ohio. This centering press is located in the production line between the furnace and piercing mill. It will accept billets heated to a temperature of about 2100 degrees F.

The press is of the horizontal type, with four-piece welded steel, tie-rod construction. All actions are electrically controlled, either manually or automatically. Horizontal piercing and clamping cylinders are hydraulically operated, while vertical clamps, ejector and kickout arms are air actuated.

The equipment illustrated handles billets ranging from 4 1/2 to 12 inches in diameter, and from 3 to 15 feet in length. Centers can be varied from 1 inch to 1 3/4 inches in diameter, and up to a depth of 6 inches. The total cycle time for centering the heated billet and delivering it to the piercing mill is three seconds.

Circle Item 567 on postcard, page 219



Billet centering press developed by the E. W. Bliss Co. for use in making steel tubing

Fig. 1. Dynapak metalworking machine tool capable of exerting tremendous pressures at high velocities for extruding and forging operations about to be fired by technician at console

Convair Dynapak High-Velocity Extruding, Forging, Forming, and Compacting Machine

A metalworking machine tool developed by Convair Division of General Dynamics Corporation, Pomona, Calif., was introduced at the recent National Metal Exposition in Cleveland. Named Dynapak, the machine, Fig. 1, may be used for high energy-rate extrusion, forging, sheet metal forming, compacting of ceramics and powdered metals, and for shearing and blanking. The illustration shows a technician at the console about to "fire" the gas-energized Dynapak. The heavy, dynamic reaction plate held by three tie bars, shown at lower right, positions the die against which the piston, at left, reacts with tremendous velocity and pressure. The control console in the background has one simple dial, by means of which the Dynapak is cycled for firing and reset. Small and compact for its strength, this Model 600 machine can be bench-mounted or secured to a concrete factory floor by only four bolts.

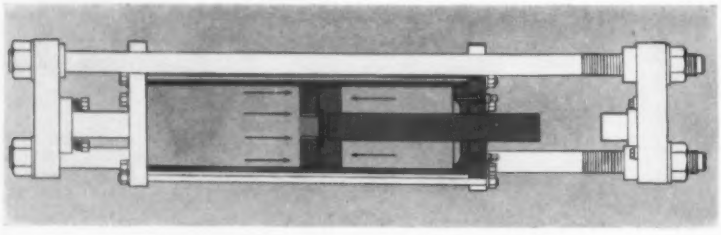


Fig. 2. Diagrammatic illustration of principle on which pneumatically operated Dynapak machine operates

Fig. 2 illustrates an age-old but seldom-employed principle of pneumatics on which the Dynapak metalworking machine is based. In the chamber at left, high-pressure gas is stored. Relatively low gas pressure in the chamber at right forces the piston against an orifice plate, and a seal in the piston face isolates all of the piston surface from the high-pressure gas except at the small area surrounded by the seal. As long as the high pressure acting on a small area and the low pressure pushing against the large area (on the back of the piston) are in balance, the machine is considered "set for firing." Application of a slight additional pressure to the high-pressure chamber at left starts the piston moving, disengaging the seal around the small hole in the orifice plate and permitting the high-pressure gas to push against the entire face of the piston. This greatly overbalances the low pressure in the chamber at the right, moving the piston at velocities of as much as 2500 feet per second. Speed is dependent upon the size of the cylinder and the pressures employed in the two chambers. Machines can be built to develop energy levels of as much as 1,500,000 foot-pounds. The cycle is repetitive every 30 seconds with 6- and 12-inch machines and once every 60 seconds with an 18-inch machine.

If the 40,000 to 1,500,000 foot-pounds of energy developed by one of these machines were hurled at a rigidly held die, no known material would withstand the force. The dynamic reaction frame provides a plate against which the load reacts. Since this plate on which the die is mounted has inertia, it can be relatively light in weight. A plate weighing 300 pounds can hold a load of two million pounds. The piece being worked will absorb much of the

energy, and the machine can be set to safely apply tremendous pressures to the working of materials such as molybdenum, titanium, and precipitation-hardening stainless steels.

Examples of steel parts extruded and forged by the new Dynapak metalworking machine tool are shown in Fig. 3. Notable among these examples are the extruded shapes in the outer half-circle, many of which display web thicknesses heretofore nearly impossible to extrude. None of the parts shown have been finish-machined. At lower center are two forgings which are unusual in that they have, essentially, a zero draft angle, improved surface finish, and minimum corner and fillet radii. These extrusions have wall thicknesses said to be several times thinner than conventional machines are capable of producing. Surface finish is claimed to be superior to conventional extrusions and dimensional tolerances are closer. Also, shapes are produced that are not obtainable by traditional methods.

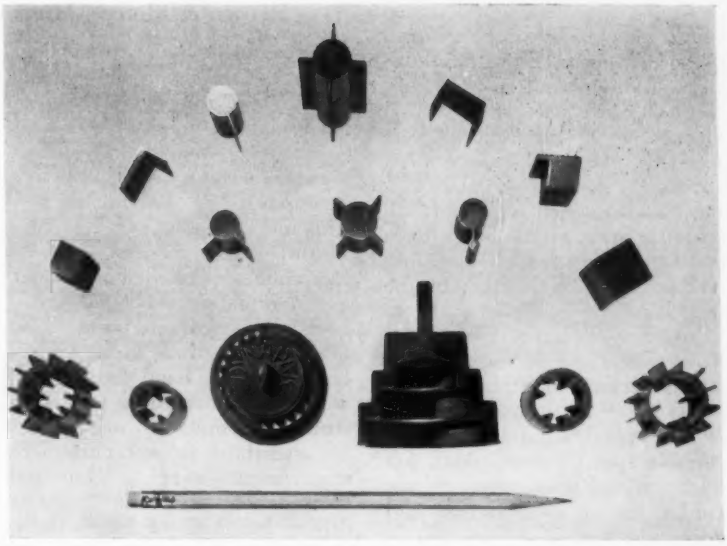


Fig. 3. Typical examples of steel parts extruded and forged by the Dynapak metalworking machine

Circle Item 568 on postcard, page 219

DoALL Band Machine for Destructive Testing of Castings

The DoALL Co., Des Plaines, Ill., has announced two band machines built specially for rapid sectioning of iron and aluminum castings. Engine blocks and similar parts with complex cores can be readily sliced apart to permit accurate inspection. This slicing operation is time-consuming and expensive when done with standard equipment because much of the cutting is through irregular cross-sections containing hard spots and occluded sand. The narrow kerf or cut made by the new band machines, especially equipped for this job, however, permits the exceptionally fast and efficient parting needed.

The smaller machine, Fig. 1, is a Model 36-2 with 25-inch work height and with a 48-inch table stroke that travels on Thomson linear ball bushings. The larger machine, Fig. 2, is a Model 36W with 36-inch work height and a 48-inch table stroke. The table has automatically lubricated V-ways.

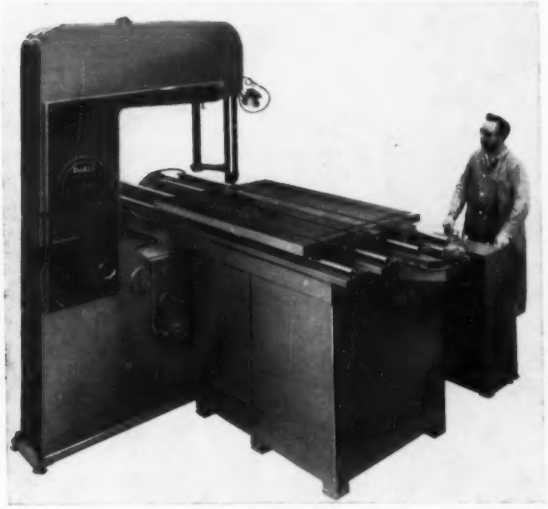


Fig. 1. DoALL band machine for sectioning medium-sized castings for destructive testing

Fig. 2. DoALL band machine built for sectioning large iron, steel, and aluminum castings

These machines are so designed that the saw band can be changed whenever necessary without disturbing the setup. Smooth, positive, hydraulic table feed provides infinitely variable rates from 1 inch to 8 feet per minute. For convenience, the operator views the work while at his control console in front of the machine. High castings can be sectioned because of the extra work height of the new machine units.

Accuracy is easily maintained when slicing low castings by means of auxiliary toolpost supports. Other features of standard DoALL band machines, such as variable speed transmissions, job selectors, and wide range of saw guides, are all incorporated into this equipment.

Table strokes up to 96 inches and work loads up to 5000 pounds are obtainable in these designs. For larger, heavier applications, a DoALL machine called the "Band Mill" is available.

Circle Item 569 on postcard, page 219

Brown & Sharpe Micromaster Grinding Machine

A completely new 618 Micromaster designed for rapid, highly accurate surface grinding of small- and medium-sized work requiring exceptional surface finish is announced by the Brown & Sharpe Mfg. Co., Providence, R. I. This machine, Fig. 1, is available in three basic models: (1) with hydraulic and hand longitudinal, and hydraulic and hand cross-feeds; (2) hydraulic and hand longitudinal, and hand cross-feeds; and (3) hand longitudinal and hand cross-feeds. Unit construction permits all machines to be assembled to suit customer's requirements—over a hundred combinations of spindles, spindle drives, locations of handwheels, etc., are possible.

As the number implies, the 618 Micromaster grinds work up to 6 inches wide and 18 inches long. Using a full-size, 8-inch wheel with the vertical adjustment handwheel located on the bed, work up to 14 inches high can be accommodated. With the handwheel on the upright, the maximum work height is 12 inches. Parts for extra vertical capacity increase these heights to 18 and 16 inches respectively.

The new Oriflex drive to the flanged type spindle, Fig. 2, is claimed to be the ultimate in smooth flow of power to the grinding wheel. It is capable of utilizing the full overload of the 1-hp, spindle-driving motor without slippage. The motor, in vibration-free mountings, drives the spindle through five "O rings." Either Oriflex or direct motor-drive spindles are available. A plain bearing Oriflex drive spindle is also available at extra cost. The latter spindle (with 8-inch wheel) runs at 2860 rpm, while the direct motor-drive spindle (with 7-inch wheel) runs at 3450 rpm.

The spindle unit is mounted in a long-bearing spindle slide, for smooth, accurate, vertical movement. Micromasters are available with the handwheel in either of two convenient locations—either at hip level on the right front of the bed or at eye level on the upright.

Dull chromium finish on the cross-feed and vertical-feed handwheels, and wide-spaced graduations, reading to 0.0002 inch, facilitate precise adjustment of the grinding wheel. For extreme accuracy of vertical adjustment, an auxiliary dial, adjacent to the handwheel, gives a fine vertical feed and is graduated to read to 0.0001 inch. This fine feed is available for the cross-feed at additional cost. As an added convenience, the graduated rims of both the cross-feed and vertical-feed handwheels are adjustable. Graduation markings on the cross-feed handwheel read both clockwise and counterclockwise, a decided advantage when grinding slots or other side-wheel work.

The hydraulic longitudinal feed of the table gives any desired rate from 5 to 100 feet per minute for the full table travel of 22 inches. The cross-feed provides any desired rate from 0.01 to 0.25 inch, available at each reversal of the longitudinal travel. A cog-belt

Fig. 1. Brown & Sharpe Micromaster surface grinder designed for rapid precision operation

drive to the table provides a smooth, positive, hand travel. Time-saving features of the hydraulically powered Micromaster include a lever that permits instantaneous changing from the selected intermittent cross-feed to a continuous feed of 10 inches per minute for wheel-truing, and vice versa. Another position of this lever results in a continuous cross-feed of 12 feet per minute for rapid positioning of the wheel.

A 3/4-hp motor drives the gear pump that supplies oil to the hydraulic system. Machine lubrication is automatic. The electrical system complies with basic JIC electrical standards. The weight of the hydraulic machine is 2500 pounds. In addition to the many attachments similar to those available for the Brown & Sharpe No. 2L (6- by 18-inch) machine, the Micromaster can be furnished with a spindle down feed arrangement and a rapid-positioning mechanism which feeds the grinding wheel vertically at the rate of 40 inches per minute.

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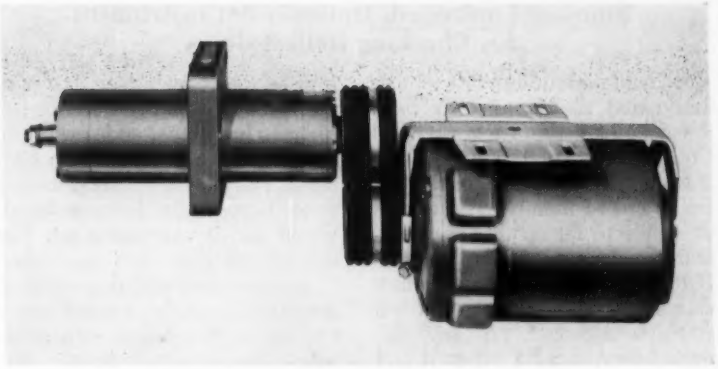

Fig. 2. Unit type wheel-spindle with Oriflex drive used on machine shown in Fig. 1

Precision Boring, Turning, and Facing Machine

A vertical type, cam-actuated precision boring, turning, and facing machine, designed along the building-block principle, has been introduced by the Hoern & Dilts Division, the New Britain Machine Co., Saginaw, Mich. Advantages claimed for these units include: accessibility of tooling, reduction of floor space, and design features that enable one operator to load and unload a greater number of spindles. Seven machines employing the building-block principle have been installed in a large transmission plant.

The principal component of these machines is a ductile cast-iron head supporting a vertical slide and cross-slide. These tool slides are actuated by a pair of cams mounted on a common shaft which is itself carried with the vertical slide. The slides are flame-hardened and ground and ride on pre-loaded roller bearings. The ways, the camshaft with its drive, and the work-spindles are all permanently lubricated with grease and sealed. Thus, day-to-day maintenance lubrication has been eliminated.

The base on which the head rests is of cast construction and serves as a housing for carriage type spindles. The sides allow a number of completely independent units to be placed side by side and to be serviced by one operator. A two-unit assembly is shown in the illustration. Chips are ejected through the back of the machine. Sturdy construction enables these machines to take heavy cuts on castings and forgings, as well as precision cuts of less than 0.0005 inch tolerance on finishing operations. The equipment is now being built in three sizes.

Circle Item 571 on postcard, page 219

Two-unit assembly of Hoern & Dilts boring, turning, and facing machines

Sine-Bar Controlled, Optically Set Instrument for Checking Helical Gears

A lead-measuring instrument, designated the 1218A, has been developed by the Michigan Tool Co., Detroit, Mich., for precision checking of helical gear leads from zero to infinity. The unit is so simple to set up that the operator needs no special training. Calculations are virtually eliminated with this sine-bar controlled machine. Although primarily designed for checking external and internal helical gears and spur gears, it will also check either right- or left-hand leads on herringbone gears or worms. The checking instrument has a capacity for gears up to 18 inches in diameter with 24-inch shafts.

A built-in optical system is the basis of the new, easy-setup method. A 56× microscope with graduated eye-piece, providing an unreversed right-side-up image, is built in over the sine-bar table. Exact-angle location is merely a matter of aligning cross-hair markings on the scope's eye-piece with the precision-graduated sine-bar plate. The scope and eye-piece serve to divide a degree into 1000 parts. The sine-bar table is merely rotated manually from a handwheel and is worm-gear set. The sine-bar plate is positively locked in position without the slightest deviation from the correct scope setting. A 56× scope with graduated eye-piece provides the precision reference against which the sine-bar plate is moved.

Combined with the optical system is an electronic gage for recording errors in tooth profiles of external and internal spur and helical gears. This unit consists of a light-load gaging head and high-response amplifier connected to a calibrated meter to visibly indicate how far off lead the work may be in increments of 0.0001 inch. Also included as part of the 1218A lead checker is an integral recording unit that provides a visual record of all checking data. This unit records, in ink, on paper printed in increments of 0.0002 inch which can be interpolated to 0.0001 inch.

The lead-measuring instrument can be operated from front or rear. The gear being checked is mounted between centers and the indicator is adjusted so that the contact point is normal to the face of the gear tooth. Turning the handwheel causes the indicator contact to glide along the face of the tooth (as the gear rotates in proper relationship due to the sine-bar control). Any deviation of the indicator shows a change from the specified lead.

The machine has two tables—a sine-bar table and a table carrying the indicator head. Both tables move on ball races. The sine-bar mechanism synchronizes the movements of the tables and workspindle in correct lead-checking relationship. The equipment requires a floor space of less than 18 square feet and is 4 feet high.

Circle Item 572 on postcard, page 219

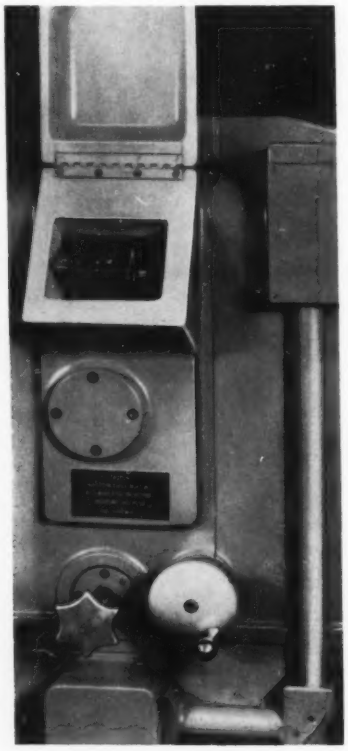

Fig. 1. (Left) Michigan lead-checking machine for internal and external helical gears
Fig. 2. (Right) Close-up of built-in optical system of lead-measuring instrument at left

Pangborn High-Capacity Rotoblast Barrel

The Pangborn Corporation, Hagerstown, Md., has introduced a heavy-duty, 20-cubic-foot Rotoblast barrel designed for high cleaning efficiency. This high-capacity Type 20 GN barrel has a 30-hp motor, which allows the 195-3 RG wheel to throw 50,000 pounds of abrasive per hour for rapid blast cleaning. The new extra-heavy work conveyor handles loads up to 3500 pounds and single pieces up to 800 pounds.

When the Rotoblast barrel is operating, the conveyor travels upward to tumble the castings. After the cleaning operation, direction of the conveyor is reversed and the load is discharged.

Abrasive-tight doors and housing permit economical use of new types of abrasives. Power-operated doors move on rollers in a mechanical labyrinth. The upper door rolls up, permitting easy access to cleaning chamber.

The lower door, which retracts under the work conveyor, is steel mesh backed with vulcanized rubber. It is powered with an air cylinder and tied in electrically so that it is impossible to run the work conveyor in reverse unless the lower door is retracted. It is also impossible to run the work conveyor forward unless the lower door is raised to closed position.

Abrasive is conveyed up to a separator at the top of the machine. At this point, sand, as well as abrasive fines and dust are drawn out of the machine. Good abrasive drops down to a storage container to be reused. The volume of abrasive flow is controlled by an orifice plate.

A quick-acting work loader, with double cables for safety, delivers each batch of work to the machine. A control panel is conveniently located alongside the cleaning chamber opening and push-buttons are used. The Pangborn 20 GN Rotoblast barrel is 8 feet, 5 inches deep by 11 feet, 10 inches wide and 16 feet, 11 3/8 inches high.

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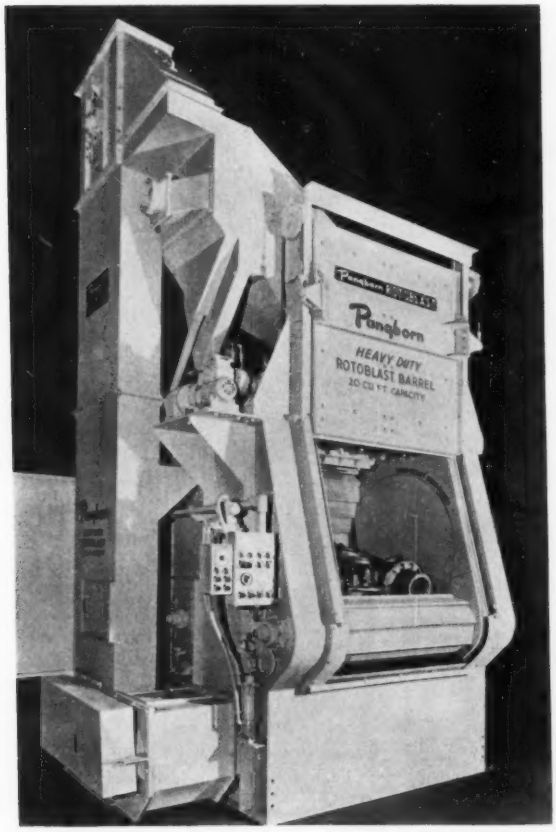
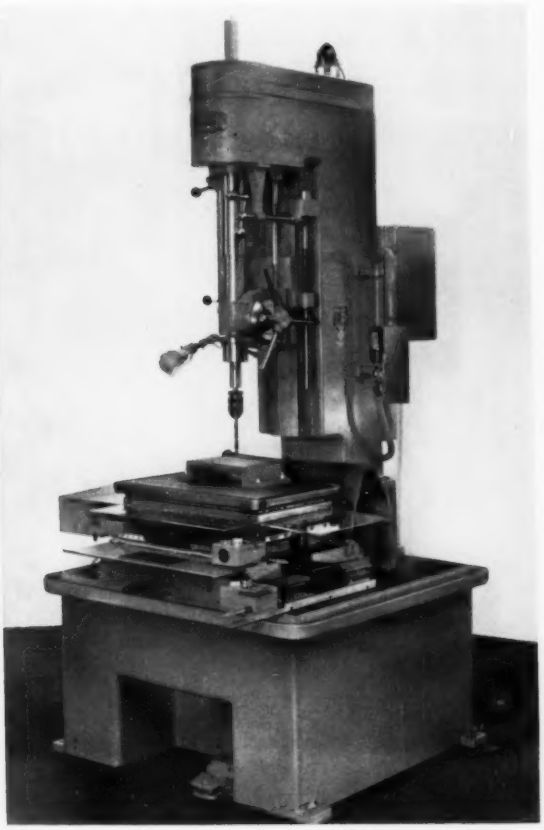
Edlund Layout Machine

A machine specifically designed to perform layout operations economically is anounced by the Edlund Machinery Co., Cortland, N. Y. Known as the Edlund No. 2, this machine will lay out work for center drilling and for drilling and reaming parts such as drill-jig bushing plates and templates. Thus it will free expensive jig-boring machines for work requiring closer tolerances.

The machine accepts several makes of compound tables. It can



Rotoblast barrel introduced by Pangborn Corporation



Layout machine developed by the Edlund Machinery Co.

be supplied with economical, simple, hand-operated, screw type tables. Time-saving, semi-automatic tables using gage-blocks or spacer bars, as well as those tables automatically programmed by tape or card, can also be employed. The unit has a heavy base and table of fabricated construction with an adequate coolant trough. A removable riser block is supplied between the base and the upper machine column so that modifications in working spindle height can be made to accommodate the different layout tables.

The spindle, of special alloy steel, has six splines and is accurately ground and fully counterbalanced. The machine has an 8 to 1 speed ratio in direct drive and features ball-bearing back-gears of 4 to 1 ratio which assure an ample speed range. Use of motors of different speeds assures a complete speed range that covers all job requirements. Provision is made for automatic power feeding of the tool.

Four standard feed rates of 0.0015, 0.0025, 0.004, and 0.0075 inch in direct drive, and four additional, heavier feed rates of 0.006, 0.010, 0.016, and 0.030 inch are provided by the back-gear drive. All of the machine bearings are of the sealed-for-life type requiring no lubrication, with the exception of two upper feed gearcase bearings, which are lubricated externally.

The machine has an electrical speed-changing device with the infinitely variable spindle speeds achieved through the use of push-buttons located on a pendent control that swivels on the side arm. Accurate spindle speed is indicated by a tachometer in the pendent box.

The rated capacity of the machine is 1 inch in cast iron and 7/8 inch in mild steel. Spindle speeds with a motor operating at 900 rpm are variable from 340 to 2700 rpm in direct drive, and 85 to 675 rpm in back-gear drive. With a motor operating at 1200 rpm, spindle speeds are variable from 450 to 3600 rpm in direct drive, and from 112 to 900 rpm in the back-gear drive.

Circle Item 574 on postcard, page 219

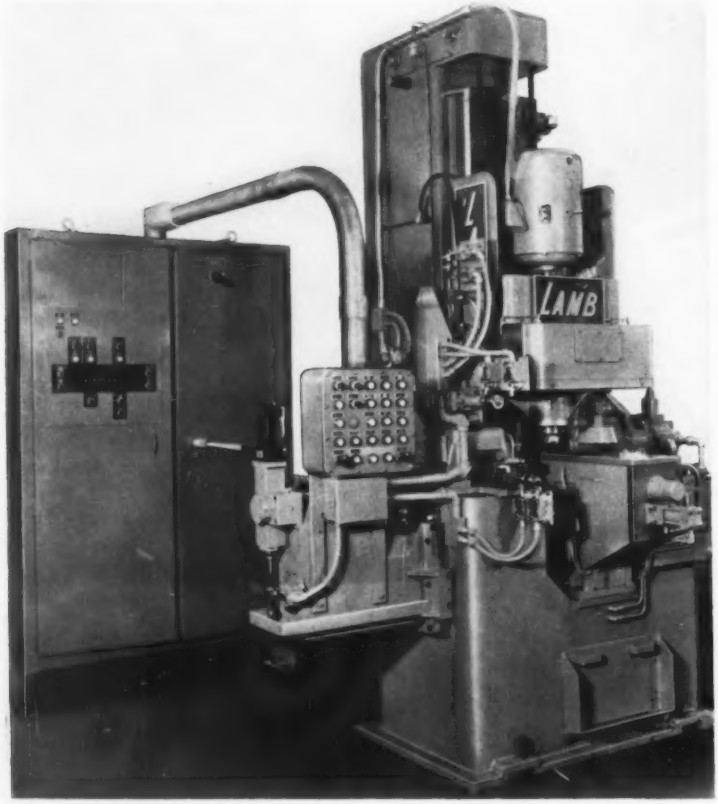
High-Production Machine for Milling Piston-Weight Bosses

A milling machine designed and built by the F. Jos. Lamb Co., Detroit, Mich., mills piston-weight bosses to precision tolerances at the rate of 425 pieces per hour. With transfer-machine design features applied to this unit, it loads, orients, clamps, mills, clears the chips, and unloads in a completely automatic cycle. Pistons of two different diameters can be accommodated by means of interchangeable tooling.

The pistons are accepted, dome down, through a loading gate which permits one part at a time to enter the loading mechanism. A loader moves the piston into jaws which align the part with the orienting head. The latter rotates the part radially, using opposing probes in the wrist-pin holes, which are offset 3/32 inch to the diameter of the piston. Circular jaws combined with clamping fingers through the wrist-pin holes hold the piston firmly against the locating seat. The oriented and clamped piston is moved through the milling, blowout, and unload stations by a trap type, rotary transfer mechanism which prevents station override.

The milling head is a Lamb standard, 10-hp hydraulic way type unit mounted in a vertical position. It rides on hardened Ohio Knife ways which assure long wear. The milling spindle is designed with pre-loaded bearings that are adjustable to take up end play. A micro adjustment for cutter depth is also provided.

Additional features include central, automatic lubrication system and special materials used in all handling mechanisms to prevent marring machined surfaces of the pistons. The entire hydraulic circuit, with the exception of the lines to the operating cylinders, is



Special piston-weight boss milling machine built by F. Jos. Lamb Co.

contained within several manifolds. Each valve is mounted on its own manifold block, the blocks being held together with tie rods and the porting between blocks being sealed with "O" rings. This arrangement keeps oil leakage at a minimum by eliminating external piping. It also allows for future changes in hydraulic circuitry by rearranging the manifold blocks. All hydraulic and electric components conform to JIC standards.

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Veet Precision Radial Drill with Spacer Table

Veet Industries, Detroit, Mich., has brought out a precision radial drill with a precision tracer table. This equipment has been developed to produce highly accurate duplicate parts without the use of expensive jigs and fixtures. The precision radial drill, with its column anchored at work level, has a high degree of rigidity. The large-diameter boring type quill coupled to the rigid column is hardened, ground, and lapped to a close fit in the head. Thus the zero-runout spindle mounted on 3-inch Timken bearings provides a radial drill capable of precision performance on the spacer table.

A setup for any desired hole pattern can be quickly arranged on the spacer table by the use of micrometers or the DeVlieg "Duplitrol" bars within a range of 14 by 18 inches, which requires only one setting of the drill head. The automatic cycle positioning of the table from hole to hole is done with a push-button and locating pins. Quick tool changes are facilitated by the automatic tool ejector. Working directly from blueprints, hole locations can be held to 0.001-inch limits.

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Norton Crankshaft Lapping Machine

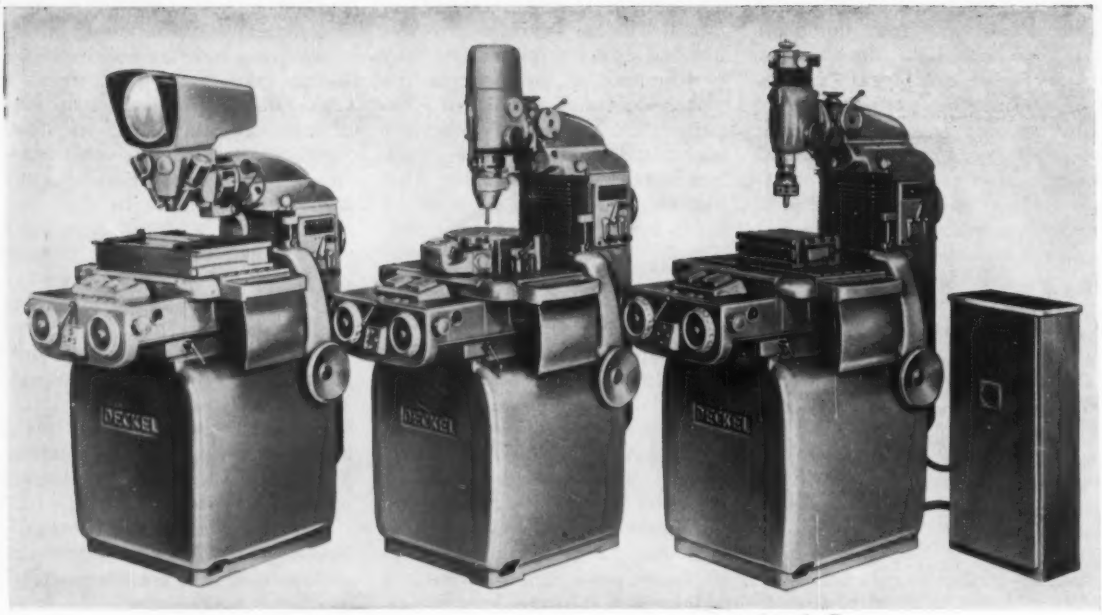
A No. 31 Crank-O-Lap crankshaft lapping machine, designed to produce fine surface finishes by means of coated abrasive strips, has been developed by the Norton Co., Worcester, Mass. This machine is designed for low-cost finishing of external diameters on automotive type crankshafts. It laps pins and bearings simultaneously, producing a low microinch finish that insures long crankshaft service life. Although especially developed to finish crankshafts, this machine can also be used to improve the finish on other types of parts.

The loading and unloading base is a special feature of this unit. Both the headstock and footstock are mounted on a swing frame which carries these members out at hand-high level to the operator, thus avoiding the need for straining or reaching. This is an important consideration when handling such relatively heavy parts as crankshafts.

After placing the crankshaft in V-blocks between the headstock and footstock, the operator merely touches a push-button. The machine then goes through the automatic work cycle. Actual work loading on centers and engagement of the work driver occur automatically, as do all other actions in the lapping process up to removal of the crankshaft from the machine.

Precision radial drill equipped with spacer table announced by Veet Industries

Crank-O-Lap crankshaft pin and bearing lapping machine announced by Norton Co.



(Left) Deckel optical projection machine. (Center) Jig-grinding machine. (Right) Jig-boring machine. The heads of these three machines are all interchangeable on one base

Because placing the work on the V-blocks is the only manual operation, the machine can be readily adapted to automatic work-loading and unloading devices. Thus, fully automatic operation may be employed if production rates warrant the purchase of the necessary equipment. Further changes beyond application of loading equipment to achieve automatic operation are minor because the necessary automatic actions otherwise required are already built into the machine.

The lapping arms are designed for low maintenance costs. Because the swing-frame mounted headstock and footstock bring the work to the lapping arms, they need only to be held in position for loading. They clamp onto the surfaces to be lapped, and when the crankshaft is rotated, the arms follow the motion of the surfaces clamped in the manner of an automotive connecting rod. The simple, jointless arms are designed to have a long service life.

The machine actions occur through the use of a few hydraulic mechanisms, all of which are on the outside of the machines so as to be instantly accessible.

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Deckel Machines with Interchangeable Heads and Direct Numerical Readings for Settings

A series of interchangeable machine tools, designated the Deckel LK Series, is being introduced in the United States by the Cosa Corporation, New York City. They provide simple interchangeability of jig-boring, jig-grinding, and optical-projection measuring heads on one base; direct numerical readings of settings; and built-in compensation for thermal expansion. They are designed to provide new standards of versatility, accuracy, and ease of operation.

The change from jig-boring to jig-grinding or optical-projection measuring takes only minutes. Individual heads are mounted on an extremely rigid bracket supported on a rugged, heavy base. Any of the three types can be used as a single-purpose machine, or all three as a universal machine with but one base.

Table measurements can be read directly in numbers to ten-thousandths of an inch (0.0001 inch). This is accomplished by the ingenious projection of precision glass scale graduations through a system of lenses and mirrors. No conversions or interpolations are required.

The stationary transverse scale is mounted on the machine base, and the movable longitudinal scale on the work-table slide. Two projection screens, one for each scale, are mounted on the cross-slide. On each scale the desired readings can be set to 0.0001 inch. The work-table is then adjusted until the projected index line of the desired setting is centralized in the proper light gap on the screen. For measuring, the procedure is reversed. Under test, operators have been able to obtain a reading accuracy of plus or minus 0.00002 inch. Actual positioning accuracy falls within 0.00012 inch. The range of coordinate readings for the jig-boring and jig-grinding machines is 15.75 by 10 inches. Work-table area for these machines is 25.6 by 11.8 inches.

To protect the inherent accuracy of these machines, the supporting bracket contains built-in compensation for thermal expansion. Additional thermal stability is provided by a special air duct that dissipates heat generated from the drive motor and by an extra large amount of oil to main-

tain practically constant gear-box temperature.

The boring spindle of the jig-boring machine, shown at the right in the illustration, has twenty different speeds ranging from 40 to 3150 rpm and six different feed rates in either of the up or down directions. The maximum work height is 24 inches.

On the jig-grinding machine, shown in the center view, the grinding spindle has twelve planetary motion speeds from 40 to 500 rpm and infinitely variable grinding speeds from 15,000 to 60,000 rpm. All types of grinding can be performed. The maximum work height is 18 3/4 inches.

The measuring machine, shown at left, will perform all types of measuring operations. It projects images on a screen 7 7/8 inches in diameter to a magnification of 10 or 20×. The useful measuring table data area is 18.7 by 10.6 inches. A wide variety of accessories is available for each machine.

Circle Item 578 on postcard, page 219

Mattison "Quick-Tilt" Spindle Rotary Surface Grinders

A quick-tilting device for creating wheel clearance on vertical-spindle rotary surface grinders is announced by the Mattison Machine Works, Rockford, Ill. This feature makes it possible to convert from rough- to finish-grinding in seconds so that advantages of both high stock removal and flat grinding can be fully realized on each job. The tilting device is designed to eliminate the time-consuming adjustments previously necessary in tilting the spindle in order to avoid "wheel drag" and to permit heavy stock removal. The elliptical form presented to the work by the leading edge of the tilted wheel produces a curvature in the work surface. Also, it is necessary to center the work under the low point on the ellipse in order to minimize this curvature. This may require readjustment of the spindle in relation to work arrangement on every job.

Mattison's Quick-Tilt spindle simplifies the problem because it makes it possible to first rough-grind every chuck load using an arbitrary 0.010-inch wheel tilt. Location of the low point makes no difference as long as there is stock available for finishing. In seconds, the spindle can be returned to the vertical position and a light finishing cut taken to produce perfectly flat parts. With this equipment there is no longer any reason for compromising accuracy to improve stock-removal efficiency, or vice versa.

A selector switch on the column, Fig. 2, actuates an air cylinder that automatically tilts the wheelhead and spindle toward the work, or tilts it back to the "dead-flat" position. Then, after reducing the rate of down feed slightly, the machine is ready for the finishing cut and sparkout.

Improvements in grinding wheels and the trend toward higher-horsepower spindle motors make the Quick-Tilt feature of greater value. It is claimed that on average grinding operations, the new equipment can increase output by as much as 50 per cent without sacrificing accuracy.

The standard Mattison No. 24 vertical rotary grinder, Fig. 1, is now offered with up to 60-hp spindle motors and pre-selected stock removal capacities up to 0.240 inch. Continuous down feed has a low feed range of from 0.005 to 0.042 inch per minute and a high range of from 0.020 to 0.165 inch. Precision is easily held with continuous down feed and automatic cycling because the last full increment of a ratchet type feed can be cut in half. Air or electric automatic sizers, using gages that contact the part being machined, hold the work to close tolerances.

Circle Item 579 on postcard, page 219

Fig. 1. (Left) Quick-Tilt Mattison vertical-spindle rotary surface grinder. Fig. 2. (Right) Operator turns the selector switch on an air cylinder to tilt spindle against a fixed stop for roughing or finishing, as desired

Niagara Plate Bending Rolls

Finger-tip controls are said to bring unprecedented ease of operation to the 9- and 10-inch diameter plate bending rolls introduced by the Niagara Machine & Tool Works, Buffalo, N. Y. Developed for rapid production of commercially true cylinders, these machines handle metal plate up to 3/4 inch thick.

Complete and instant control over forward and reverse rotation of the rolls is provided by a squirrel-cage brake type motor, momentary-contact push-buttons, and oversize magnetic contactors. The rolls deliver full torque the instant buttons are pressed. A powerful brake stops the rolls instantly on release of either button, prevents drifting, and provides close control for inching. Other push-buttons control the raising or lowering of the power-adjusted rear roll for quick positioning to the desired cylinder diameter.

Flat spots in sheets of all thicknesses are virtually eliminated by the pinch type rolls. The three-roll power drive enables work to be started more easily and curved more accurately. Longitudinal grooves on the roll facilitate one-pass forming of small diameter cylinders.

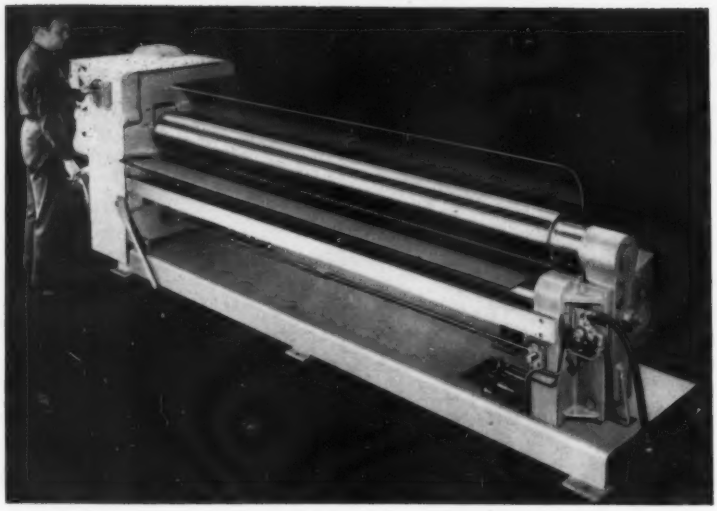


Plate bending rolls brought out by the Niagara Machine & Tool Works

Optional features include: air-operated drop end; centralized-pressure lubrication; cone-rolling attachment; counter type indicator; and hardened and ground rolls for forming highly finished materials such as those used in missile fabrication. Both the 9-inch and 10-inch diameter series are built in six sizes to handle materials up to 168 feet long.

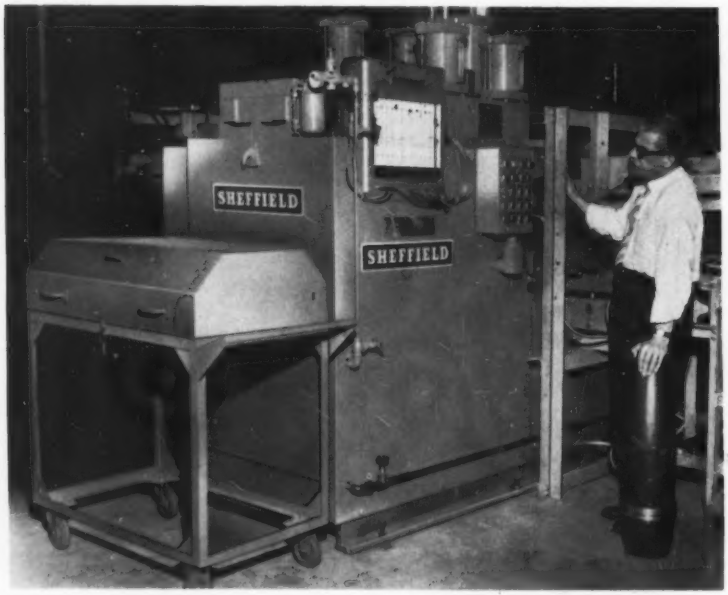
Circle Item 580 on postcard, page 219

Gage for Automatically Checking 8-Inch Shells

A push-button Precisionaire gage that automatically inspects thirteen dimensions and conditions on an 8-inch shell has been made by the Sheffield Corporation, Dayton, Ohio, a subsidiary of Bendix Aviation Corporation. The pneumatic gage checks seven outside diameters. A retractable gaging member enters the shell through the nose to check thread chamfer, length, and rear-wall thickness.

The multiple-dimension type of gage also determines the location and width of the band groove and several concentricities of bourrelet and intermediate body to front- and rear-body diameters. Each dimension must be held to size within tolerance limits of 0.0001 inch.

The 13-column Precisionaire instrument shows by the position of its air floats whether the dimensions are within the required tolerances, or the amount they are out-of-tolerance. Both gaging and transfer timing can be adjusted to handle different shells or similar type components. An endless pressure belt rotates the shell 360 degrees for complete circumferential checking.



Sheffield gage for checking 8-inch shells installed in the Wisconsin plant of National Presto Industries, Inc.

Circle Item 581 on postcard, page 219

OMEGA miniature cold-heading machine introduced by Robert E. Morris Co.

Morris Omega Miniature Cold-Heading Machine

The Robert E. Morris Co., Hartford, Conn., has introduced an OMEGA "00" cold-heading machine, designed primarily for quick and accurate cold-heading of miniature parts. Electrical contacts, rivets, pins, and similar parts as small as 0.012 inch in diameter by 0.016 inch long can be produced on this machine.

The OMEGA "00" is a standard, solid die, double-stroke heading machine which will cut to length, head and form between 80 and 120 pieces per minute, all to extremely close tolerances. The maximum wire diameter accommodated is 0.070 inch with most alloys and up to 0.120 inch with soft aluminum. Part lengths may range from 0.016 inch to 0.400 inch. Hollowing of rivets as well as heading may be performed in one operation. The depth of the hole, depending on the material being used, is equal to three times the wire diameter in aluminum and 1 1/2 times in copper and brass.

A minimum of maintenance and service is required. A one-shot lubrication system is provided for the entire unit. One set of dies for making a specific part is supplied with each machine. Coil reel, straightening rolls, feed rolls, built-in V-belt drive, and guards are standard equipment. The machine itself is built into an attractive cabinet base with handy storage drawers. The cabinet also includes a unique "double-decker" drawer for receiving completed parts and to facilitate taking samples for inspection. This drawer also permits removal of batches of parts without stopping production.

The machine is 33 1/2 inches wide, 29 1/2 inches deep, 47 inches high, and weighs approximately 300 pounds. Power is furnished by a 1/2-hp, 220-volt, 3-phase, 60-cycle motor.

Circle Item 582 on postcard, page 219

Pre-Selector Machine Control System

An electromechanical machine-management or controlling system that permits operators to "dial" changes in machine setup is now available from Seneca Falls Machine Co., Seneca Falls, N. Y. This system is available as a package and can be applied to machine tools, conveyor systems, and a variety of other work-positioning devices that would benefit by remote dial control. The pre-selector system is designed to drastically reduce machine setup time, and is, therefore, particularly suited for short-run production operations. Essentially, the system (shown diagrammatically in the illustration) functions by amplifying electrical signals and moving the work-piece to any "pre-selected" position indicated on the dials. If a new work-position setup is desired, it is only necessary to change dial readings. In a typical existing lathe application, the machine-management system controls the positions of both carriage and cross-feed slide by means of panel dials. The dial for carriage positioning is graduated for travel in increments of 0.001 inch and the dial for the cross-feed, for diameter settings to 0.001 inch.

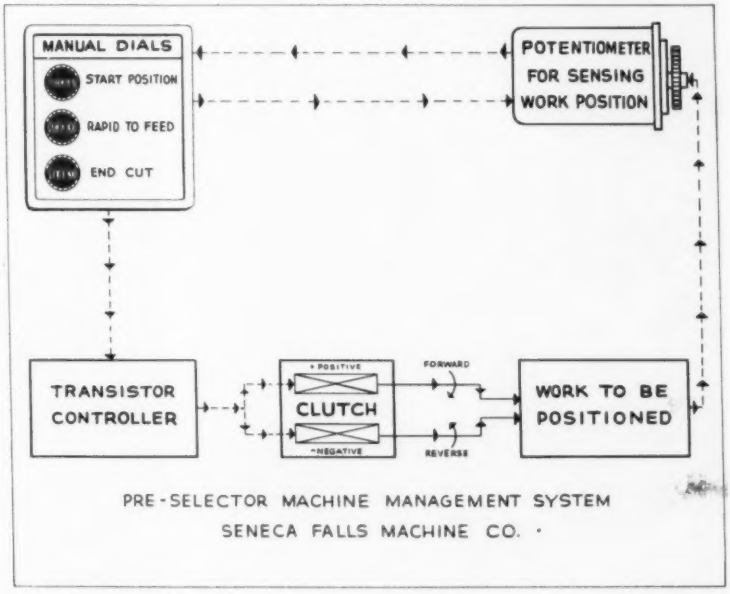


Diagram illustrating operation of pre-selector machine control announced by Seneca Falls Machine Co.

Carriage position is controlled by automatic comparison of two precision potentiometers. One potentiometer is located at the control panel and its output voltage is determined by dial setting calibrated in inches of carriage travel. The second oil-immersed potentiometer is mounted on the carriage itself and voltage output is a function of actual carriage position. Each carriage position produces a different voltage output. The dial and carriage potentiometers are interconnected and continuous comparison is made between the output voltage of each. The latter is the same only when the actual carriage position corresponds to the dial setting. If the carriage position and dial setting do not correspond, the difference in voltage between the two potentiometers is sensed and the carriage is automatically driven to the "null point" where the carriage position and dial setting correspond. Multiple dial settings may be compared in sequence to control a consecutive series of carriage positions.

Actual physical motion of the carriage is controlled by a clutch actuated by voltage phase (positive or negative). Positive phase actuates the forward clutch; negative, the reverse clutch. When the difference between carriage and dial voltage is zero (null point) the clutch is de-energized and the carriage stops. The system provides rapid-traverse approach with automatic switch to feed rate for the final carriage position.

Cross-feed slide position is controlled by essentially the same principle as that used for the carriage position. One potentiometer is coupled to the slide itself, and its voltage is compared to that of the second potentiometer which is manually set for the desired diameter. Here again, several manually set dials can be used so that different diameters can be obtained with each pass. The principles illustrated by the lathe applications are equally applicable to other machine tools.

Circle Item 583 on postcard, page 219

"Roto-Grind" Precision Rotary Table and Combination Power Drilling and Checking Fixture

The M-M Tool Mfg. Co., Dayton, Ohio, has brought out a motorized, precision rotary table that is said to double the capacity of a 6- by 18-inch surface grinder. This "Roto-Grind" table, Fig. 1, will fit on any surface grinder in either the horizontal or vertical position. It will grind the surface of a 12-inch diameter plate flat and parallel to a tolerance of 0.000050 inch (fifty millionths). When mounted in the vertical position, the table can be used for inside- and outside-diameter grinding.

The "Roto-Grind" can be used in conjunction with jig grinding for finishing large rings or offset holes. The motor can be disengaged to permit manual operation. For larger work, 15-, 18-, 20-, 24-, and 36-inch machines with variable speed motors are available. The standard models have 6- and 11-inch diameters.

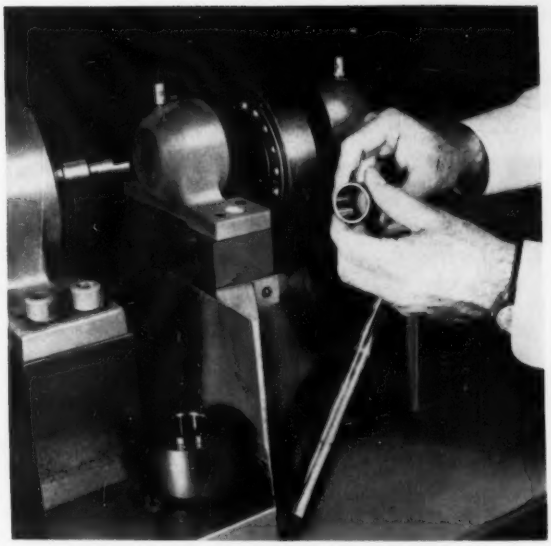
The combination power drilling and checking fixture, Fig. 2, is another recently announced M-M product. This device can also be used as a fixture for grinding any combination of slots, squares, hexagons, etc. It will serve as a versatile accessory for jig grinder or jig borer. It can be used for boring or drilling holes in plates on bolt circles of 1-, 2-, 3-, 4-, 6-, 8-, 12-, and 24-hole combinations. It can also be used for grinding radii and contours.

Circle Item 584 on postcard, page 219

Fig. 1. "Roto-Grind" precision rotary table

Fig. 2. M-M power drilling and checking fixture

"Weldanpower" unit brought out by the Lincoln Electric Co. to provide alternating current for arc welding and also serve as auxiliary power generator



Inside diameter of Amplex ferrous-base bearing shows very little wear after operation for hours under heavy load. Shaft retains original mirror-like surface

Lincoln Combination Welder and Auxiliary Power Generator

A combination alternating-current power supply and arc welder has been announced by the Lincoln Electric Co., Cleveland, Ohio. This "Weldanpower" machine serves as a 5-kva power supply for use in the event of commercial power failure or where the latter is not available. In addition, it serves as a 200-ampere alternating-current welder.

"Weldanpower" has a heavy-duty, Wisconsin air-cooled, four-cycle Model TFD engine which delivers 13.1 hp at 2000 rpm. The low engine speed is said to reduce engine wear and thus extend its life.

The unit provides 115- or 230-volt, 60-cycle, alternating-current, single-phase power and is rated at 5 kva, continuous duty. The load can be connected to the machine at the outlets provided on the control panel. The four 115-volt receptacles are located on the left-hand side of the panel, and the 230-volt receptacle is located on the right. The receptacles lock conventional flat-blade plugs in place. Maximum continuous current at 230 volts is 18.2 amperes. "Weldanpower" will start and run motors as large as 3 hp. The speed, when used as a power-supply unit, is 1820 rpm. It supplies 20 to 200 amperes of alternating current for maintenance welding and hard-surfacing. Five taps with a rheostat for intermediate settings provide accurate, continuous current control. The machine handles 5/64-inch through 3/16-inch electrodes. Engine speed, when set for welding, is 2100 rpm. Separate windings for the welding and power circuits make it possible to weld and supply power at the same time when necessary. The unit weighs only 537 pounds.

Circle Item 585 on postcard, page 219

Amplex Ferrous-Base Self-Lubricating Bearing

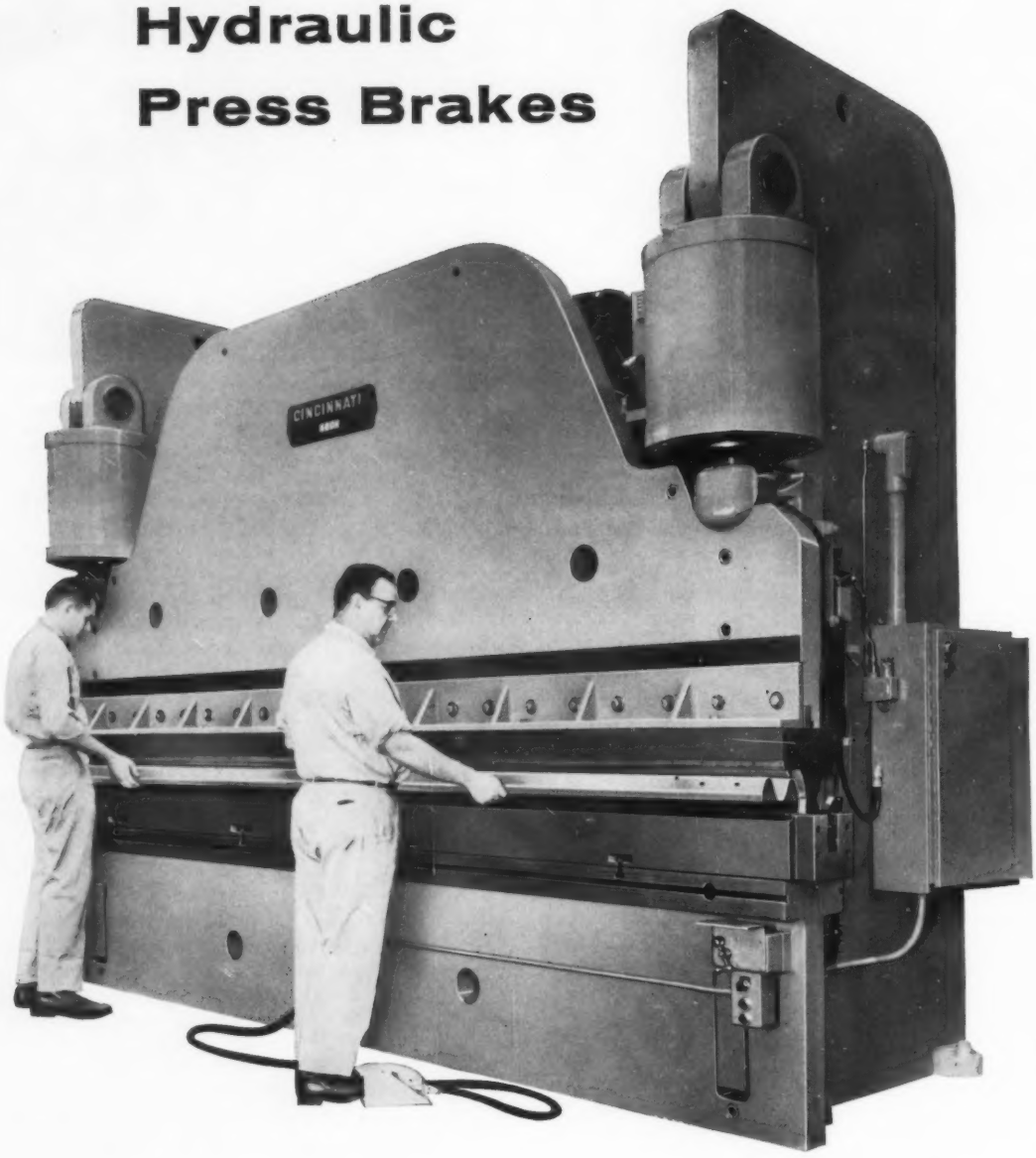
A powder-metal bearing that is claimed to be capable of effecting major savings for equipment manufacturers has been developed by the Amplex Division, Chrysler Corporation, Detroit, Mich., and is now commercially obtainable. This ferrous-base, powder-metal bearing has been developed to meet the need for a general-purpose sleeve bearing that is more economical than porous bronze, and is not dependent upon strategic copper. Comprised chiefly of iron powders, bearings made from the new ferrous-base composition will cost considerably less than comparable bearings now made from porous bronze. The reason for the saving is a substantial 4 to 1 cut in the cost of constituent materials.

When subjected to exhaustive life tests and service under actual operating conditions, the new ferrous-base bearings have consistently demonstrated performance equal to porous bronze. They can be used advantageously on a wide range of products where corrosion is not a problem and mechanical strength requirements are within tolerable limits. Suggested uses include bearing and bushing applications on home appliances, fractional horsepower motors, power tools, light machinery, instruments, light vehicles, communication equipment, and other products. A built-in service factor makes the bearings especially suitable for oscillating and reciprocating motion where the nature of the movement prevents the build-up of an oil film.

The new bearing material has a porosity of 18 to 23 per cent oil by volume; ultimate tensile strength of 10,000 psi; compressing yield

(*Continued on page 188*)

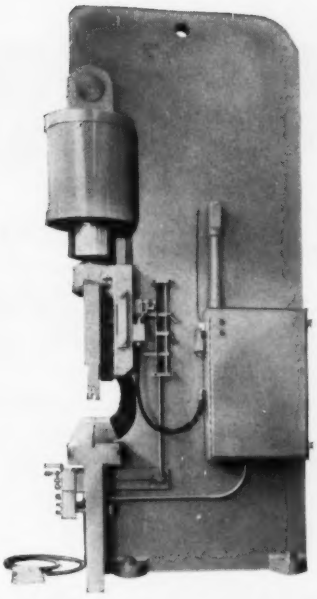
3 basic advantages of CINCINNATI® Hydraulic Press Brakes



Cincinnati® Hydraulic Press Brakes, now available in 300, 400, 500, and 600 ton capacities, are not substitutes for Cincinnati® Mechanical Press Brakes. Where high production, maximum accuracy, and greatly increased tonnage at the bottom of the stroke are required, Cincinnati Mechanical Press Brakes remain unchallenged. However, where accuracy requirements are not extremely critical, where high speed is not necessary and where long strokes are desirable, Cincinnati Hydraulic Press Brakes offer important advantages—some entirely new to the field of hydraulic press brakes.

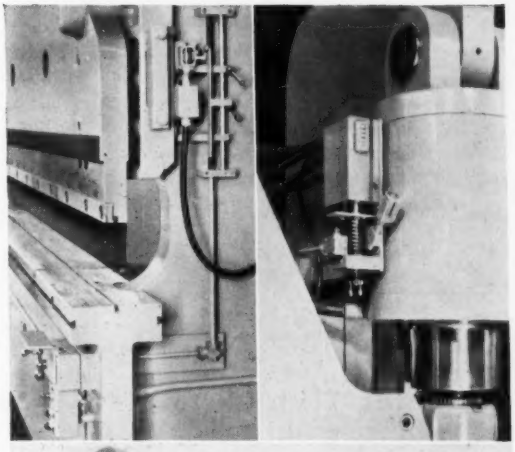
1 Accuracy

A special Cincinnati feature is extra heavy housings which extend above the cylinders, providing a means for their unique clevis mounting. This gives true center-line loading: vertical thrust of the cylinders is carried by the housings *without welds or bolts*. The cylinders are connected to the ram with ball joints and are self-aligning in all directions. Binding of pistons and ram slides cannot occur. In addition, deep beds and rams, and large radii at all stress points minimize deflection and insure maximum accuracy. With Cincinnati interlocked construction, the bed is supported directly by the housings *without* load bearing welds.



2 Convenience

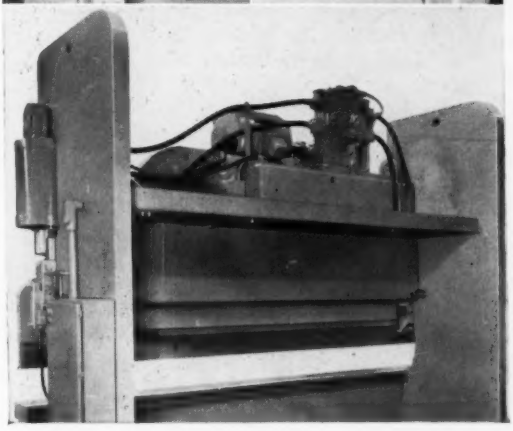
All controls are at right end of the machine, within easy reach of the operator. The bottom stroke-stop adjusting crank is on the front of the bed. Micrometer registers are provided to indicate both the bottom stroke-stop and ram tilt adjustments, a great convenience in setting dies on initial or repeat setups. Tonnage, stroke length, and ram position are easily set. Indicator lights tell direction ram is moving or ready to move. Machine cannot overload: it reverses when loaded to any given tonnage setting.



3 Economy

Greatly simplified maintenance and reduced cost result from Cincinnati's exclusive hydraulic manifold block, which brings valves and piping together in one compact assembly. The usual maze of valves, pipes and fittings is eliminated. High pressure joints are reduced to a minimum, which means important maintenance economies, year after year.

Write Dept. D for informative Bulletin HB-1.



Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO. Cincinnati 11, Ohio, U.S.A.

For more data, circle page number of this ad on inquiry card

Fig. 1. Federal electronic test indicator

point of 9500 psi; Rockwell hardness of RH-35; and specific gravity of 6.1 to 6.5. A high oil content—approximately 20 per cent by volume—assures the bearing a sufficient supply of oil to make it self-lubricating for the lifetime of many products. A unique, built-in service factor permits the bearing to operate even without oil for short periods and makes it resistant to temporary overloads.

Circle Item 586 on postcard, page 219

Federal Electronic Test and Eccentricity Indicators

A portable Model No. 230 P-3 electronic test indicator, Fig. 1, designed to supplement its previously announced Model 230 P-2 electro-probe, has been brought out by Federal Products Corporation, Providence, R. I. The new indicator provides additional measuring ranges, extending the freedom of portable precision to an even greater number of applications. These ranges are ±0.001 inch with 0.00005-inch graduations, and ±0.0002 inch with 0.00001-inch graduations.

The instrument consists of the electro-probe gage head and lightweight, completely portable, battery-powered transistor amplifier plus a handy carrying case. The gage head operates with a gaging pressure of less than 2.5 grams, making special fixtures unnecessary. Ordinary test set or height gage fixtures can be used with assurance that there will be no distortion or deflection to affect the gage reading.

The electro-probe can be quickly applied to precision measurement on a surface plate or at the machine. It is also valuable for precision machine tool setup work.

An improved eccentricity indicator, Fig. 2, called the "Model No. A-93 Eccentricator," is another recent development in this line. This spindle-actuated, precision-switching mechanism, when combined with signal lights, indicates eccentricity, runout, lack of squareness, or wobble. These variations in work-piece condition are accurately indicated while the instrument ignores normal piece-to-piece variation in size.

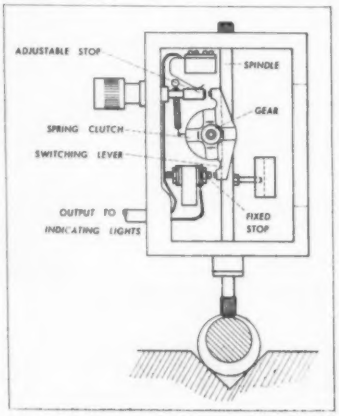
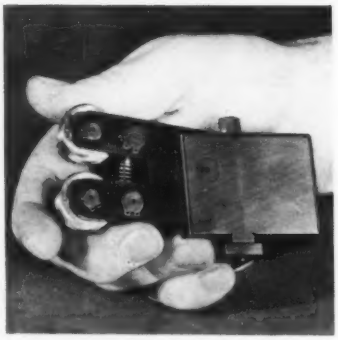


Fig. 2. Eccentricator indicator

The Eccentricator reduces the time needed to make measurements of this type because it automatically indicates the extent of the variations directly. Since it provides an electrical signal, it is readily applied to automatic as well as manual inspection. The balanced design and light weight enable it to follow variations accurately, without vibration.

Circle Item 587 on postcard, page 219



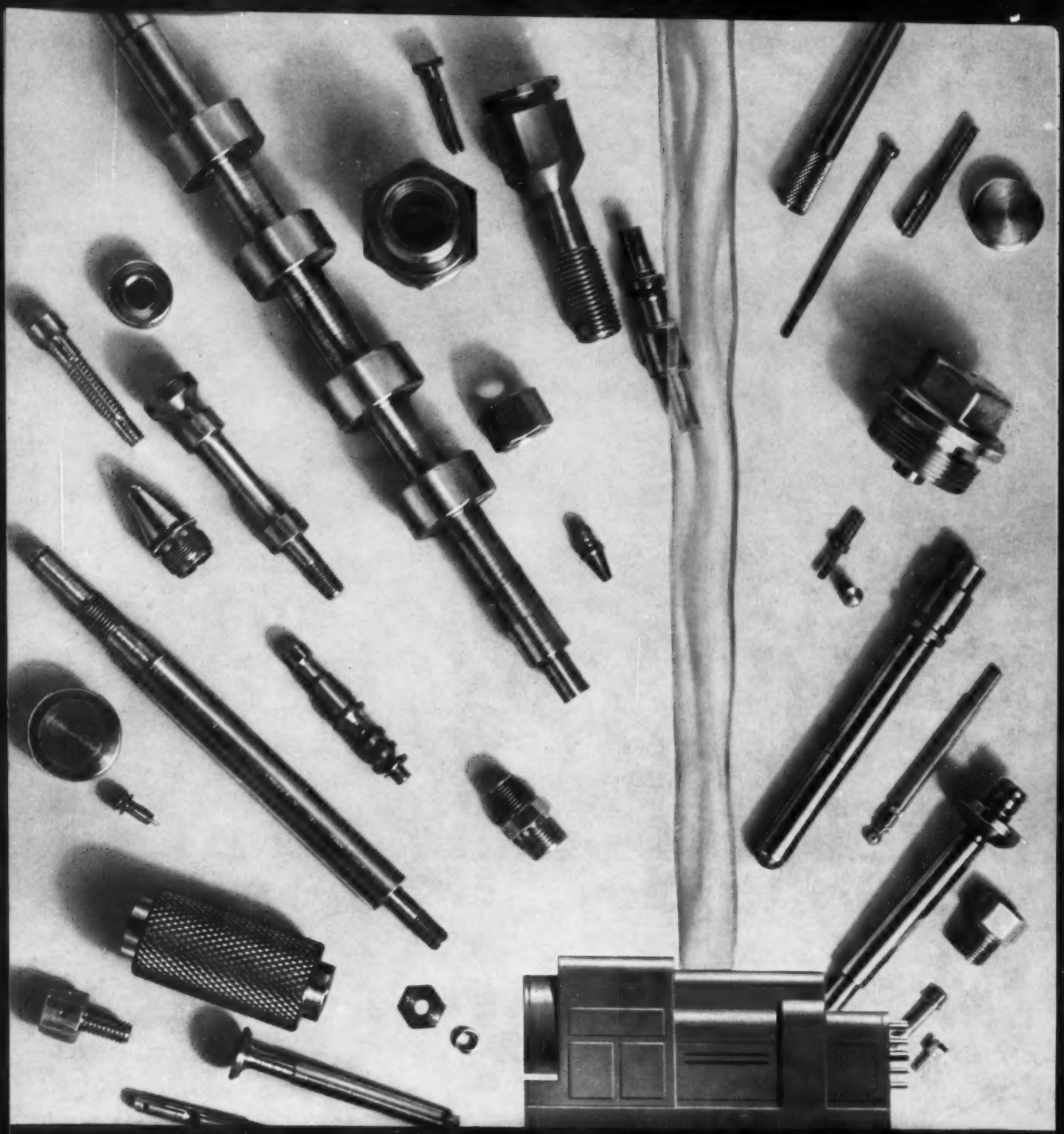
Sheffield thread-rolling attachment

Thread-Rolling Attachment

An attachment for rolling threads up to 1/4 inch outside diameter for use on the "00" Brown & Sharpe and the 9/16 inch Acme-Gridley machines is announced by the Sheffield Corporation, Dayton, Ohio, a subsidiary of Bendix Aviation Corporation. This attachment will roll threads from No. 0-80 to 1/4-20 with a maximum thread length of 1/2 inch. It makes possible roll-over threading of small parts instead of single-side "bump" rolling that could distort the part because of excessive side pressure. Synchronous rotation of the rolls is obtained through a gear train. The rolls are easily changed and adjusted for size. The head pivots in an adapter so that the rolls automatically position themselves in relation to the center line of the spindle on contact with the work-piece. The head is also allowed to float sideways to minimize side pressure on the rolls as unit is fed into the work.

Circle Item 588 on postcard, page 219

(This section continued on page 196)

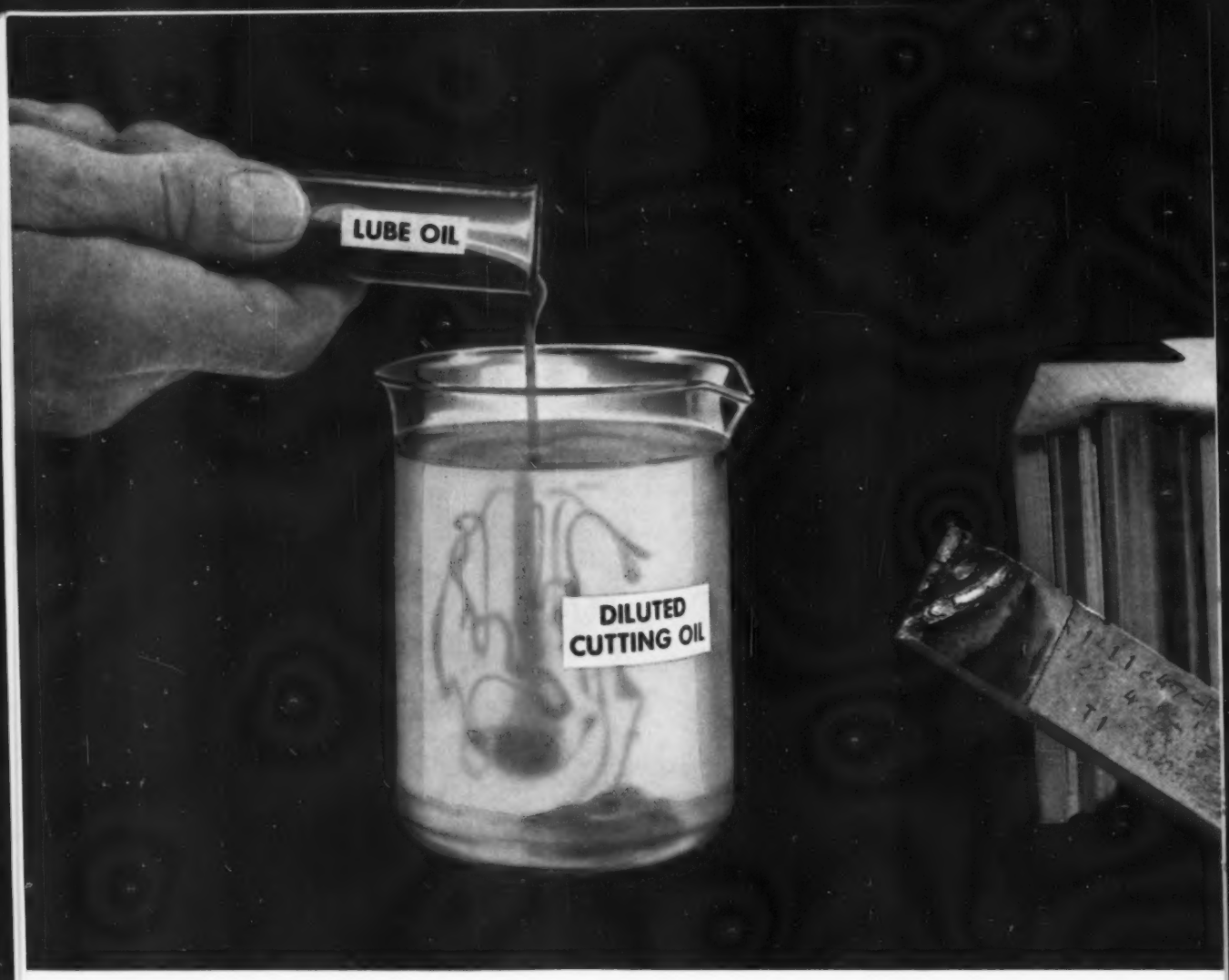


1/3 MORE PRODUCTION FROM 7 OUT OF 10 AUTOMATICS

with

the Texaco Cleartex Cure

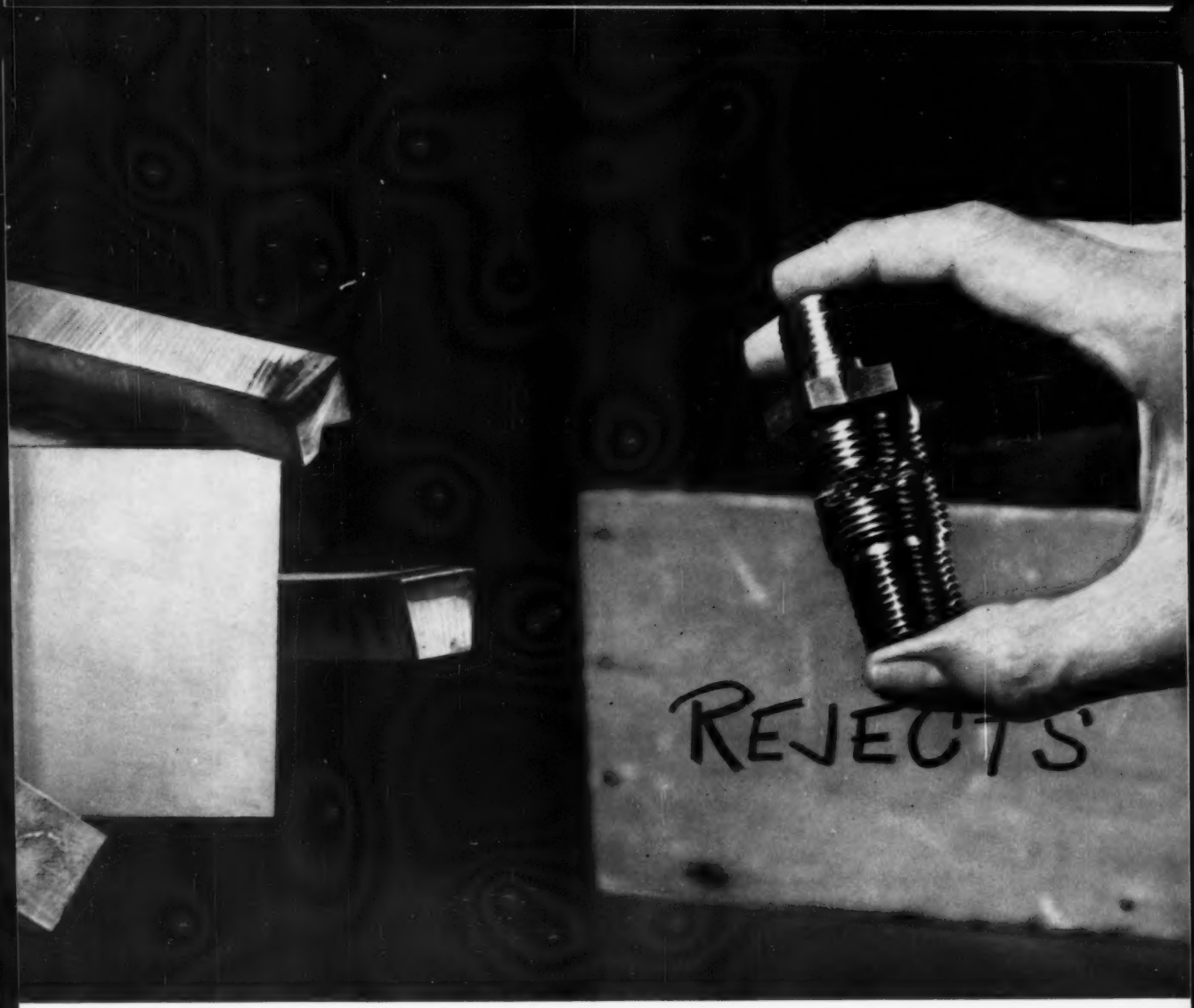
TEXACO



3 TO 8 GALLONS OF LUBE OIL PER SHIFT leak into the cutting oil sump on 7 out of 10 automatics now operating. This cumulative reduction of cutting oil efficiency is actually to blame for many screw machine problems.

SHORT TOOL LIFE due to chip weld, cratering, burning, can often be traced directly to lube oil dilution of cutting oil effectiveness. Your

Diluted cutting oil causes costly troubles in automatic screw machines . . . short tool life . . . frequent downtime. Diluted cutting oil can be cured . . . forever! Prove it yourself . . . Start the Texaco



saving in tool regrinds, tool replacement and downtime offsets the price of premium Cleartex many times over.

A CRITICAL SYMPTOM of cutting oil dilution in your automatic screw machines is excessive scrap production. Another, and earlier one to watch for, is frequent need to refill lubricating oil sumps.

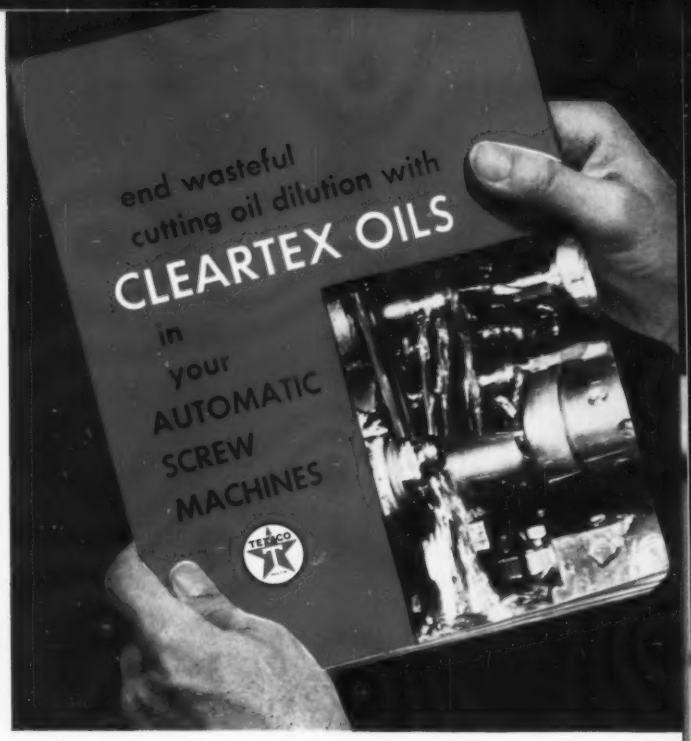
HERE'S HOW: First, call in a Texaco Lubrication Engineer. Let him survey your automatic set-up—metals being machined, operating conditions, etc. Then, if your automatic screw machines are of the vast majority that can benefit from the Texaco Cleartex Cure, use a Cleartex Oil for *both* cutting and lubricating in just one machine as a test. On 70% of automatics in use today, men in charge of production and maintenance run into recurring troubles that they can actually cure with this one decision.

Cleartex Cure

TURN PAGE FOR DETAILS OF METHOD

SEND FOR THIS NEW TEXACO BOOK NOW!

To do your job . . . stop waste and boost output . . . compete better on quality . . . you need to know what Cleartex Oils can do in automatic screw machines. This book spells it out.



See for yourself how Cleartex helps you reduce operating costs

How Cutting Oil Is Diluted

When lubricating and hydraulic oils leak into the cutting oil sump, the cutting oil is diluted. It loses strength; ingredients that make it an efficient cutting oil become less and less effective. This happens more frequently than is realized.

One way to make a quick check is to keep a record of how much lubricating oil (or hydraulic fluid) is being added to a machine. Lube oil make-up is a good measure of dilution on the cutting oil side and a sign that tool life and production is probably being lost.

Cleartex Cures the Problem

Texaco Cleartex Oils were developed to cure this problem forever.

The Cleartex Series are transparent, non-corrosive products. Despite their non-corrosive features, they do have relatively high extreme pressure properties, which make them well suited as general purpose cutting oils for use in a wide variety of operations where requirements are normal.

On non-ferrous metals, they are particularly effective because they are non-corrosive.

They are also excellent as machine tool lubricants and hydraulic fluids, principally because of their exceptional chemical stability, load carrying ability and rust preventing properties. Thus, they are truly efficient dual or tri-purpose oils. In addition, Cleartex Oils have excellent odor, color, E.P. properties, corrosion protection.

How to Set Up a Test

Cleartex Oils are demonstrably superior to any dual or tri-purpose lubricants available today. It also seems apparent that the cost of operating 70% of the automatic screw machines can be reduced by the use of a Cleartex Oil. We say this because on automatic screw machines that now use the new Texaco Cleartex Oils for cutting, lubricating, and (if needed) hydraulic fluid, difficulties of short tool life, rejects and downtime have been cured, or definitely reduced.

Why don't you arrange with a Texaco Engineer to make a test on one machine—or on an entire line if you want to go for the savings immediately. Contact any one of Texaco's 2,000 Distributing Plants in the 48 States, or write to The Texas Company, 135 East 42nd Street, New York 17, N. Y.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

OUNCE-INCHES OF TORQUE FOR GIVEN HORSEPOWER AND SPEED—3

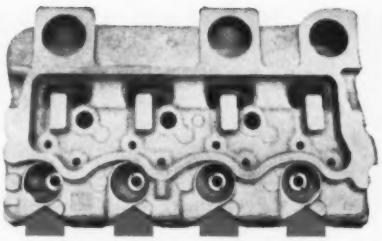
	H.P.															
	1/2000	1/1500	1/1250	1/1000	1/750	1/600	1/500	1/400	1/300	1/250	1/200	1/150	1/125	1/100	1/90	1/75
R.P.M.	TORQUE, OUNCE-INCHES															
7100	.071	.095	.114	.14	.19	.24	.28	.36	.47	.57	.71	.95	1.14	1.42	1.58	1.90
7300	.069	.092	.111	.14	.18	.23	.28	.35	.46	.55	.69	.92	1.11	1.38	1.54	1.84
7500	.067	.090	.108	.14	.18	.22	.27	.34	.45	.54	.67	.90	1.08	1.35	1.50	1.80
7600	.066	.089	.106	.13	.18	.22	.27	.33	.44	.53	.66	.89	1.06	1.33	1.48	1.77
7800	.065	.086	.104	.130	.17	.22	.26	.32	.43	.52	.65	.86	1.04	1.30	1.44	1.73
8000	.063	.084	.101	.126	.17	.21	.25	.32	.42	.50	.63	.84	1.01	1.26	1.40	1.68
8100	.062	.083	.100	.125	.17	.21	.25	.31	.42	.50	.62	.83	1.00	1.25	1.39	1.66
8300	.061	.081	.097	.122	.16	.20	.24	.30	.41	.49	.61	.81	.97	1.22	1.35	1.62
8500	.059	.079	.095	.119	.16	.20	.24	.30	.40	.48	.59	.79	.95	1.19	1.32	1.58
8600	.059	.078	.094	.117	.16	.20	.24	.29	.39	.47	.59	.78	.94	1.17	1.30	1.57
8800	.057	.077	.092	.115	.15	.19	.23	.29	.38	.46	.57	.77	.92	1.15	1.28	1.53
9000	.056	.075	.090	.112	.15	.19	.22	.28	.37	.45	.56	.75	.90	1.12	1.25	1.50
9100	.055	.074	.089	.111	.15	.18	.22	.28	.37	.44	.55	.74	.89	1.11	1.23	1.48
9300	.054	.072	.087	.109	.14	.18	.22	.27	.36	.43	.54	.72	.87	1.09	1.21	1.45
9500	.053	.071	.085	.106	.14	.18	.21	.27	.35	.42	.53	.71	.85	1.06	1.18	1.42
9600	.053	.070	.084	.105	.14	.18	.21	.26	.35	.42	.53	.70	.84	1.05	1.17	1.40
9800	.052	.069	.082	.103	.14	.17	.21	.26	.34	.41	.52	.69	.82	1.03	1.14	1.38
10000	.050	.067	.081	.101	.13	.17	.20	.25	.34	.40	.50	.67	.81	1.01	1.12	1.35
10100	.050	.067	.080	.100	.13	.17	.20	.25	.33	.40	.50	.67	.80	1.00	1.11	1.34
10300	.049	.065	.078	.098	.13	.16	.20	.24	.33	.39	.49	.65	.78	.98	1.09	1.31
10500	.048	.064	.077	.096	.128	.16	.19	.24	.32	.38	.48	.64	.77	.96	1.07	1.28
10600	.048	.064	.076	.095	.127	.16	.19	.24	.32	.38	.48	.64	.76	.95	1.06	1.27
10800	.047	.062	.075	.094	.125	.16	.19	.23	.31	.37	.47	.62	.75	.94	1.04	1.25
11000	.046	.061	.073	.092	.122	.15	.18	.23	.31	.37	.46	.61	.73	.92	1.02	1.22
11100	.045	.061	.073	.091	.121	.15	.18	.23	.30	.36	.46	.61	.73	.91	1.01	1.21
11300	.045	.060	.072	.089	.119	.15	.18	.22	.30	.36	.45	.60	.72	.89	.99	1.19
11500	.044	.059	.070	.088	.117	.15	.18	.22	.29	.35	.44	.59	.70	.88	.98	1.17
11600	.044	.058	.070	.087	.116	.14	.17	.22	.29	.35	.44	.58	.70	.87	.97	1.16
11800	.043	.057	.063	.086	.114	.14	.17	.21	.28	.34	.43	.57	.68	.86	.95	1.14
12000	.042	.056	.067	.084	.112	.14	.17	.21	.28	.34	.42	.56	.67	.84	.93	1.12
12100	.042	.056	.067	.083	.111	.14	.17	.21	.28	.33	.42	.56	.67	.83	.93	1.11
12300	.041	.055	.066	.082	.110	.14	.16	.20	.27	.33	.41	.55	.66	.82	.91	1.10
12500	.040	.054	.065	.081	.108	.13	.16	.20	.27	.32	.40	.54	.65	.81	.90	1.08
12600	.040	.053	.064	.080	.107	.13	.16	.20	.27	.32	.40	.53	.64	.80	.89	1.07
12800	.040	.053	.063	.079	.105	.13	.16	.20	.26	.32	.40	.53	.63	.79	.88	1.05
13000	.039	.052	.062	.078	.104	.129	.16	.19	.26	.31	.39	.52	.62	.78	.86	1.04
13100	.039	.051	.062	.077	.103	.128	.15	.19	.26	.31	.39	.51	.62	.77	.86	1.03
13300	.038	.051	.061	.076	.101	.126	.15	.19	.25	.30	.38	.51	.61	.76	.84	1.01
13500	.037	.050	.060	.075	.100	.125	.15	.19	.25	.30	.37	.50	.60	.75	.83	1.00
13600	.037	.050	.059	.074	.099	.124	.15	.19	.25	.30	.37	.50	.59	.74	.82	.99
13800	.037	.049	.059	.073	.098	.122	.15	.18	.24	.29	.37	.49	.59	.73	.81	.98
14000	.036	.048	.058	.072	.096	.120	.14	.18	.24	.29	.36	.48	.58	.72	.80	.96

Extracted from engineering-data chart compiled by the John Oster Mfg. Co., Avionic Division, Racine, Wis.

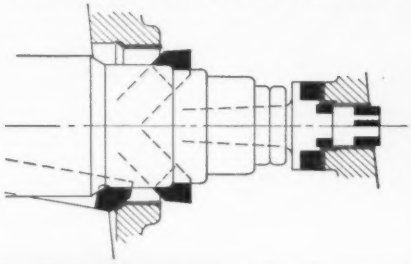
OUNCE-INCHES OF TORQUE FOR GIVEN HORSEPOWER AND SPEED—4

	H.P.														
	1/60	1/50	1/40	1/35	1/30	1/25	1/20	1/15	1/12	1/10	1/8	1/6	1/5	1/4	1/3
R.P.M.	TORQUE, OUNCE-INCHES														
7100	2.37	2.84	3.6	4.1	4.7	5.7	7.1	9.5	11.8	14.2	17.8	23.7	28.4	35.6	47.4
7300	2.30	2.77	3.5	4.0	4.6	5.5	6.9	9.2	11.5	13.8	17.3	23.0	27.7	34.6	46.1
7500	2.24	2.69	3.4	3.8	4.5	5.4	6.7	9.0	11.2	13.5	16.8	22.4	26.9	33.7	44.9
7600	2.21	2.66	3.3	3.8	4.4	5.3	6.6	8.9	11.1	13.3	16.6	22.1	26.6	33.2	44.3
7800	2.16	2.59	3.2	3.7	4.3	5.2	6.5	8.6	10.8	13.0	16.2	21.6	25.9	32.4	43.2
8000	2.10	2.52	3.2	3.6	4.2	5.0	6.3	8.4	10.5	12.6	15.8	21.0	25.2	31.6	42.1
8100	2.08	2.49	3.1	3.6	4.2	5.0	6.2	8.3	10.4	12.5	15.6	20.8	24.9	31.2	41.6
8300	2.03	2.44	3.0	3.5	4.1	4.9	6.1	8.1	10.1	12.2	15.2	20.3	24.4	30.4	40.6
8500	1.98	2.38	2.97	3.4	4.0	4.8	5.9	7.9	9.9	11.9	14.8	19.8	23.8	29.7	39.6
8600	1.96	2.35	2.94	3.4	3.9	4.7	5.9	7.8	9.8	11.7	14.7	19.6	23.5	29.4	39.2
8800	1.91	2.30	2.87	3.3	3.8	4.6	5.7	7.7	9.6	11.5	14.3	19.1	23.0	28.7	38.3
9000	1.87	2.25	2.81	3.2	3.7	4.5	5.6	7.5	9.4	11.2	14.0	18.7	22.5	28.1	37.4
9100	1.85	2.22	2.77	3.2	3.7	4.4	5.5	7.4	9.2	11.1	13.9	18.5	22.2	27.7	37.0
9300	1.81	2.17	2.72	3.1	3.6	4.3	5.4	7.2	9.0	10.9	13.6	18.1	21.7	27.2	36.2
9500	1.77	2.12	2.66	3.0	3.5	4.2	5.3	7.1	8.9	10.6	13.3	17.7	21.2	26.6	35.4
9600	1.75	2.10	2.63	3.0	3.5	4.2	5.3	7.0	8.8	10.5	13.2	17.5	21.0	26.3	35.1
9800	1.72	2.06	2.57	2.95	3.4	4.1	5.2	6.9	8.6	10.3	12.9	17.2	20.6	25.7	34.3
10000	1.68	2.02	2.52	2.88	3.4	4.0	5.0	6.7	8.4	10.1	12.6	16.8	20.2	25.2	33.7
10100	1.67	2.00	2.50	2.86	3.3	4.0	5.0	6.7	8.3	10.0	12.5	16.7	20.0	25.0	33.3
10300	1.63	1.96	2.45	2.80	3.3	3.9	4.9	6.5	8.2	9.8	12.3	16.3	19.6	24.5	32.7
10500	1.60	1.92	2.40	2.75	3.2	3.8	4.8	6.4	8.0	9.6	12.0	16.0	19.2	24.0	32.1
10600	1.59	1.90	2.38	2.72	3.2	3.8	4.8	6.4	7.9	9.5	11.9	15.9	19.0	23.8	31.8
10800	1.56	1.87	2.34	2.67	3.1	3.7	4.7	6.2	7.8	9.4	11.7	15.6	18.7	23.4	31.2
11000	1.53	1.84	2.30	2.62	3.1	3.7	4.6	6.1	7.6	9.2	11.5	15.3	18.4	23.0	30.6
11100	1.52	1.82	2.28	2.60	3.0	3.6	4.6	6.1	7.6	9.1	11.4	15.2	18.2	22.8	30.3
11300	1.49	1.78	2.23	2.55	2.98	3.6	4.5	6.0	7.4	8.9	11.2	14.9	17.9	22.3	29.8
11500	1.46	1.76	2.20	2.51	2.93	3.5	4.4	5.9	7.3	8.8	11.0	14.6	17.6	22.0	29.3
11600	1.45	1.74	2.18	2.49	2.90	3.5	4.4	5.8	7.3	8.7	10.9	14.5	17.4	21.8	29.0
11800	1.43	1.71	2.14	2.45	2.85	3.4	4.3	5.7	7.1	8.6	10.7	14.3	17.1	21.4	28.5
12000	1.40	1.68	2.10	2.40	2.80	3.4	4.2	5.6	7.0	8.4	10.5	14.0	16.8	21.0	28.0
12100	1.39	1.67	2.09	2.39	2.78	3.3	4.2	5.6	7.0	8.3	10.4	13.9	16.7	20.9	27.8
12300	1.37	1.64	2.05	2.35	2.74	3.3	4.1	5.5	6.8	8.2	10.3	13.7	16.4	20.5	27.4
12500	1.35	1.62	2.02	2.31	2.70	3.2	4.0	5.4	6.7	8.1	10.1	13.5	16.2	20.2	27.0
12600	1.34	1.60	2.00	2.29	2.67	3.2	4.0	5.3	6.7	8.0	10.0	13.4	16.0	20.0	26.7
12800	1.32	1.58	1.97	2.25	2.63	3.2	4.0	5.3	6.6	7.9	9.9	13.2	15.8	19.7	26.3
13000	1.29	1.55	1.94	2.22	2.59	3.1	3.9	5.2	6.5	7.8	9.7	12.9	15.5	19.4	25.9
13100	1.28	1.54	1.93	2.20	2.57	3.1	3.9	5.1	6.4	7.7	9.6	12.8	15.4	19.3	25.7
13300	1.26	1.52	1.90	2.17	2.53	3.0	3.8	5.1	6.3	7.6	9.5	12.6	15.2	19.0	25.3
13500	1.25	1.50	1.87	2.14	2.49	2.99	3.7	5.0	6.2	7.5	9.4	12.5	15.0	18.7	24.9
13600	1.24	1.48	1.86	2.12	2.47	2.97	3.7	5.0	6.2	7.4	9.3	12.4	14.8	18.6	24.7
13800	1.22	1.46	1.83	2.09	2.44	2.93	3.7	4.9	6.1	7.3	9.2	12.2	14.6	18.3	24.4
14000	1.20	1.44	1.80	2.06	2.40	2.88	3.6	4.8	6.0	7.2	9.0	12.0	14.4	18.0	24.0

Extracted from engineering-data chart compiled by the John Oster Mfg. Co., Avionic Division, Racine, Wis.



MACHINES 21 CYLINDER HEAD SURFACES IN ONE PASS WITH DEPTH OF CUT BETWEEN 1/8" AND 3/16"
Rough castings are bored, plunge-faced and chamfered at a rate of 18 parts per hour. Tooling is shown below.



NEW!

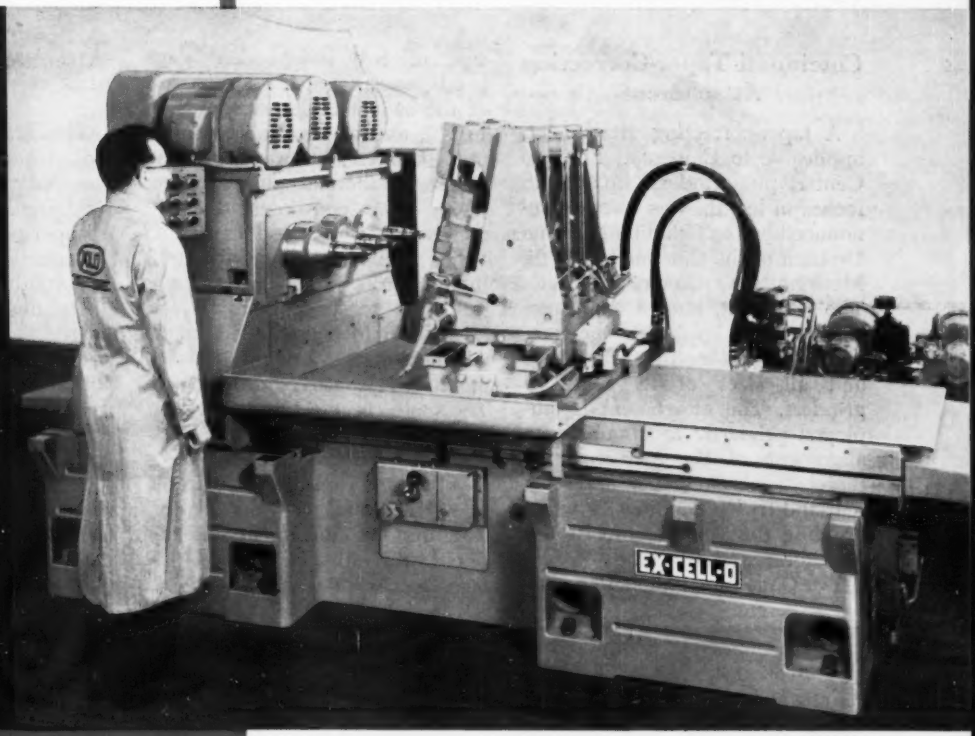
Heavy-Duty Precision Boring Machine

From base to bridge-top, Ex-Cell-O's new Style 771 Precision Boring Machine is engineered to keep pace with changing production needs and built to give years of precise profitable performance.

A specialist in fast, heavy-duty work such as the multiple machining operations detailed at left, the Style 771 (and the companion double-end Style 772) provides ample work space for complex tooling setups and bulky fixtures.

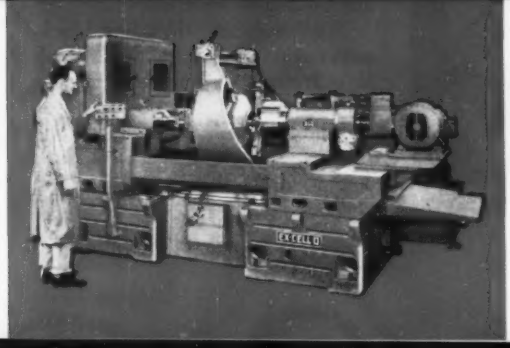
In-built versatility permits a broad range of rough, semi-finish and finish operations with automatic cycling. Rigid construction gives the "beef" needed for machining large, heavy parts, and supplies a wide margin of steadiness for high production of smaller precision parts.

Ex-Cell-O Precision Boring Machines can put greater precision into your products at lower per-unit cost. Get the full story from your local Representative, or write direct.



RIGHT: Style 771 machines both 4-and-6-cylinder tractor components. As cycle starts, table rapids to left, spindles rotate and feed traverse begins. At end of stroke, table rapids out to clear tooling; fixture indexes, cycle repeats for second set of holes.

BELOW: Double-end Style 772 performs multiple machining operations on tractor gear case cover.



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58-49

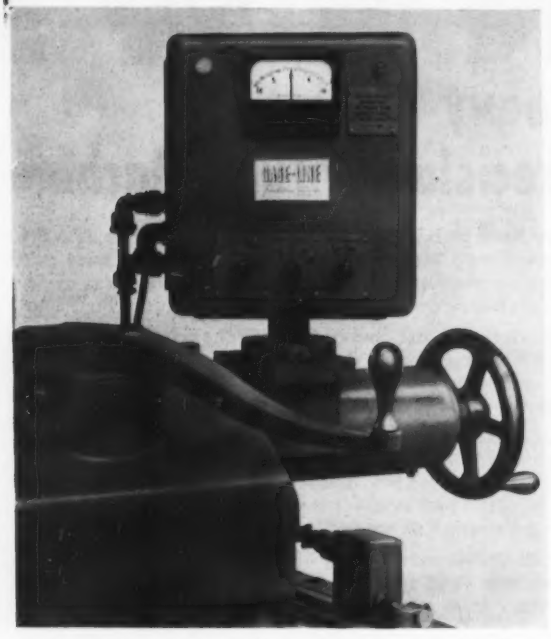


Fig. 1. Cincinnati "Gage-Line" taper-correcting attachment

Motorized milling spindles with right-angle attachments

Cincinnati Taper-Correcting Attachment

A taper-correcting attachment, applicable to Cincinnati Filmatic Centertype grinders up to 48 inches in length, was recently announced by the Grinding Machine Division of the Cincinnati Milling Machine Co., Cincinnati, Ohio. The new unit, known as "Gage-Line," can be applied to the company's 4- to 14-inch plain grinders and all sizes of its universal grinders. The attachment is employed primarily to obtain exact alignment of the swivel table, thereby eliminating uncertain "cut-and-try" methods when grinding the work to precise accuracy for straightness.

The Gage-Line attachment consists of two independent gage heads, one mounted on each end of the swivel table, as shown in Fig. 2, and an electronic control unit mounted on the bed or some other member of the machine where it is convenient for the operator, as illustrated in Fig. 1. When the swivel table is adjusted, the control unit electronically translates the signal from each gage head to a graduated meter which shows the amount of movement and length of work-piece. The meter is selective for a high and low range totaling 0.020 inch and 0.002 inch, respectively. Electrical switches on the control unit select the range of work length, magnitude of adjustment, and the signal from either gage head.

Circle Item 589 on postcard, page 219

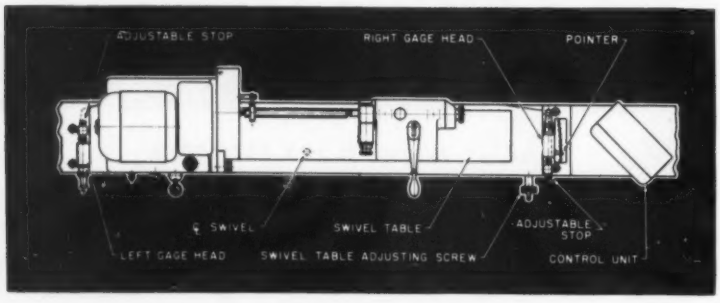


Fig. 2. Diagram showing arrangement of Gage-Line taper-correcting equipment

Attachments for Motorized Milling Spindles

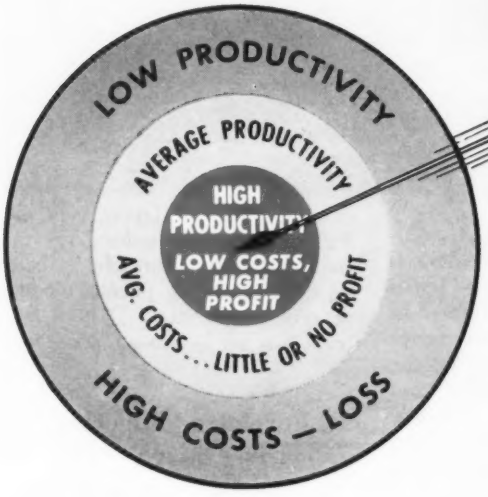
The Standard Electrical Tool Co., Cincinnati, Ohio, has announced the development of two right-angle attachments for its line of super-precision, motorized milling spindles, ranging in sizes from 1 to 200 hp. The unit shown at 3 in the illustration is an accessory for the assembly shown at 1. At 2 is a right-angle attachment with No. 50 NMTB nose, while at 3 the right-angle attachment is shown with a No. 30 or No. 40 NMTB nose.

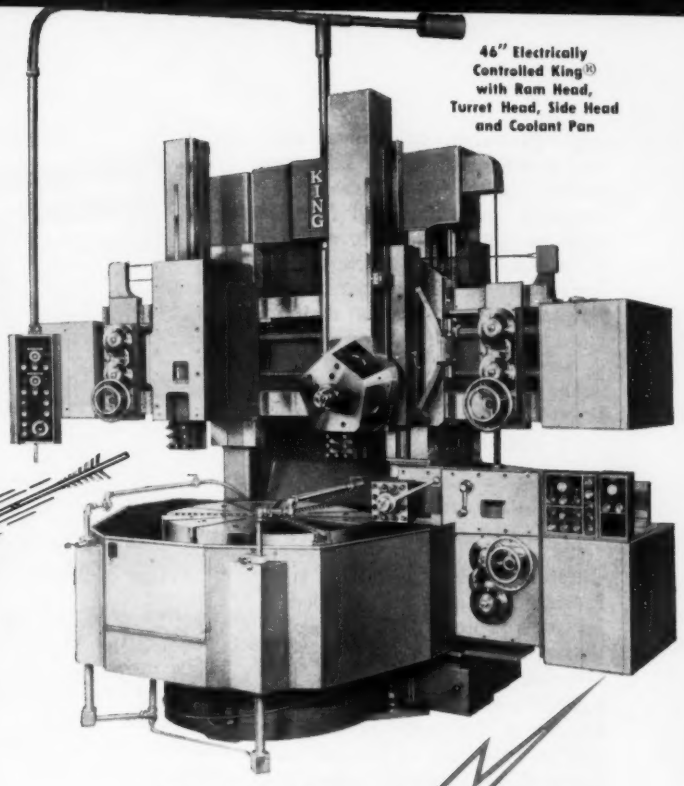
Each size and type of milling spindle, whether direct-motorized or independent-drive, has the conventional NMTB nose. When the right-angle attachment is applied, the nose of the milling spindle accommodates the NMTB arbor serving as the driving shaft of the right-angle attachment. The latter attachment may be positioned at any 90-degree location.

The typical building-block-automation assembly at 1 is available from the "endless versatile variations" of super-precision spindles, slides, and automatic circuits, as well as other standard components listed by the manufacturer. This Standard No. 6009

IF YOU DON'T HIT THE "BULL'S EYE"

...You Can't Win the Game!





46" Electrically Controlled King® with Ram Head, Turret Head, Side Head and Coolant Pan

High productivity is the one and *only* way to victory in today's intense competition in metalworking. This is the "bull's eye" you must hit in order to get lower production costs with resultant maximum profit.

You will be "on target" when you put your boring, facing, and turning jobs on the new King® *Electrically Controlled* Vertical Boring and Turning Machine. This new King is designed and built to bring boring mill users advanced, vitally-essential competitive advantages—in faster set-up . . . faster operation . . . higher, uniformly maintained accuracy . . . *greatly increased productivity.*

Full electrical control cuts manipulation time to a bare minimum in both set-up and operation. Increased horsepower and expanded feed and speed ranges cut machining time and provide greater job versatility. Extra-heavy rugged construction and simplified design assure exceptionally low maintenance cost.

To "hit the bull's eye" of profits on your boring, facing, and turning operations, see your authorized King Distributor, or write us direct.

Full Electrically Controlled KING

HAS ALL THESE ADVANCED FEATURES—AND MANY MORE!

- **COMPLETE ELECTRICAL CONTROLS**—conveniently located on movable pendant station and machine-mounted panel.
- **INCREASED HORSEPOWER**—40 and 50 H.P. on 30", 36", and 46" sizes, 75 and 100 H.P. on sizes 56" and up—available in any one of three speed ranges.
- **EXPANDED FEED AND SPEED RANGES**—24 feeds from .0016" to .250" per revolution. 24 speeds in any one of three standard ranges—low, intermediate, or high.
- **DIALS FOR PRE-SELECTION OF FEEDS AND SPEEDS.**
- **IMPROVED SPINDLE MOUNTING**—with extra-heavy spindle, provides maximum table stability with resulting higher, uniformly maintained accuracy.
- **AUTOMATIC LUBRICATION of all moving parts.**
- **MACHINE ADAPTED FOR OPTIONAL ADDITION OF:** Automatic feed stops . . . Automatic cycling . . . Automatic tracing control of heads . . . Power indexing of turrets.

AMERICAN STEEL FOUNDRIES, KING MACHINE TOOL DIVISION
1150 TENNESSEE AVENUE, CINCINNATI 29, OHIO

KING Vertical Boring and Turning Machines

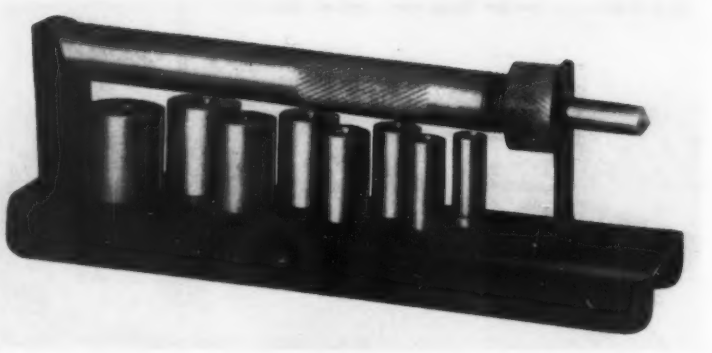
super-precision, motorized milling spindle with 3 hp, 1200 rpm motor, No. 40 NMTB nose is assembled on a Standard No. 1E slide having non-metallic ways. It is equipped with 8-inch stroke, hydraulic power cylinder, and constant-feed oilers. The reciprocating feed is assembled with limit switches for cycling, including rapid traverse and controlled feed through electric solenoid valves.

Circle Item 590 on postcard, page 219

Peterson Sonoflux Inspection Equipment

Peterson Machine Tool, Inc., Merriam, Kan., has developed a line of magnetic-particle inspection equipment and supplies. This Sonoflux equipment has been designed to meet critical, high-level inspection demands. More positive identification of defects and speed of processing time and operation are two important benefits claimed for this new equipment, which is said to meet the exacting military and industrial requirements. Quality-built Sonoflux crack and flaw detection units are now available in a wide variety of portable and booth types. These magnetic inspection units for non-destructive testing of ferrous materials can be furnished to meet any production schedules.

Circle Item 591 on postcard, page 219



Hole-center finder kit made by James Products Co.

Hole-Center Finder

A tool designed for fast, accurate spotting of hole centers is being introduced by the James Products Co., Mentor, Ohio. In one simple operation this device transfers the location of a hole, establishes its center point, and marks it for easy drill location. The tool comes in a kit form, consisting of one center punch made of hardened and ground tool steel and eight sleeve plugs. Sizes range from 5/16 to 3/4 inch. Sleeve plugs are 1 inch long. All plug diameters are held to plus or minus 0.001 inch to allow for precise and accurate layout work.

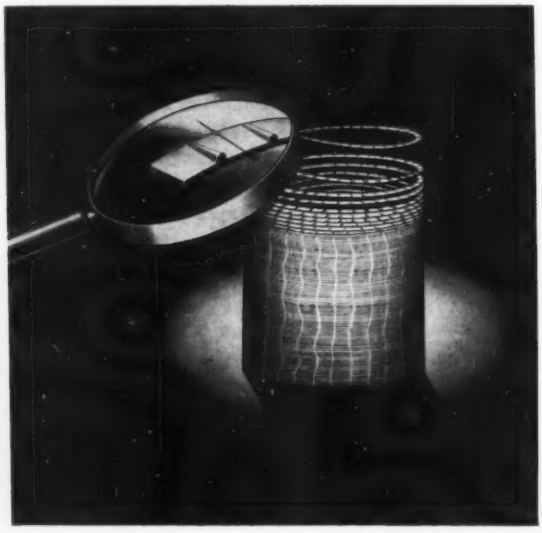
The hole-center finder kit is designed to serve as essential tool equipment for every toolmaker, machinist, maintenance man, machine builder, and layout man, or for use wherever holes have to be transferred accurately. It can be used on metal, plastic, wood, or other material.

Circle Item 592 on postcard, page 219

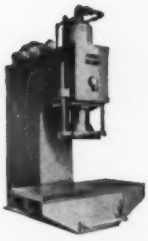
Purolator Filter Has Nuclear Applications

A frameless metal-edge filter element is a recent development of Purolator Products, Inc., Rahway, N. J. It is made by winding a metal ribbon in a helix to form a cylinder. In cross-section, the ribbon has a trapezoidal shape. During the processing, roller dies produce conical risers in one side of the ribbon, as can be seen in

Booth type Sonoflux magnetic-particle inspection machine introduced by Peterson Machine Tool, Inc.



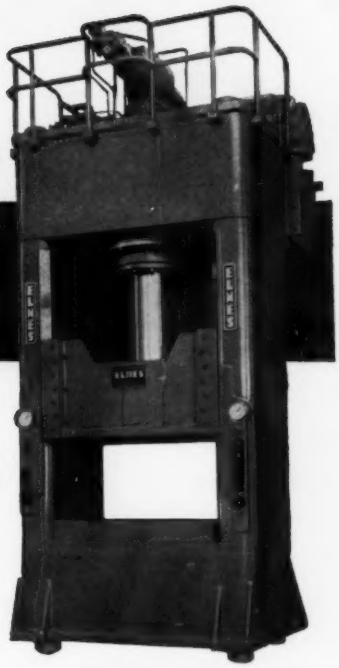
Helical ribbon of filter element has trapezoidal cross-section and integral conical risers



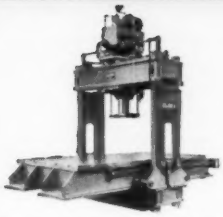
C-FRAME PRESS — for general purpose straightening, bending forcing, forming. Fast, flexible.

Elmes...

will "Job-Fit" hydraulic press equipment



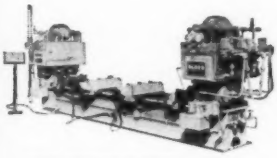
Drawing and Forming



TRAVELING HEAD STRAIGHTENING PRESS — custom-built to meet special requirements.

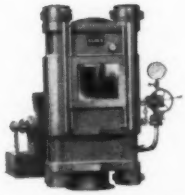
to meet *your* requirements... exactly

Whether you're seeking improved and more economical press performance for your present metalworking production, or there's a development planning job to be done, you can count on Elmes to provide *the right press for the job.* Elmes builds a complete line of standard hydraulic presses for a broad range of metalworking operations—for drawing and forming, coining, forging, hobbing, bending, straightening, forcing, powder metal compacting, etc.



TUBE REDUCING PRESS—another unit custom-designed for a specialized type of production.

One of these standard Elmes® designs, "as is" or with simple modifications, may fit your needs exactly. Or, your requirements may be so special as to call for development of a "custom-built" press—a type of press designing and building which has long been an important part of Elmes service to industry.



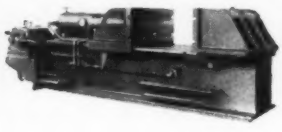
HOBBING PRESS — a powerful tool for sinking hardened hobs into blanks of cold steel.

Whatever your "pressing problem", *it will pay you to call in Elmes.* It just makes sense to take advantage of engineering knowledge, skill, and foresight *backed by more than 60 years of leadership in specialized hydraulic service.*

See your Elmes distributor, or write us direct. Recommendations and cost estimates will be supplied promptly.

Also a complete line of COMPRESSION and TRANSFER PRESSES for PLASTICS and RUBBER MOLDING

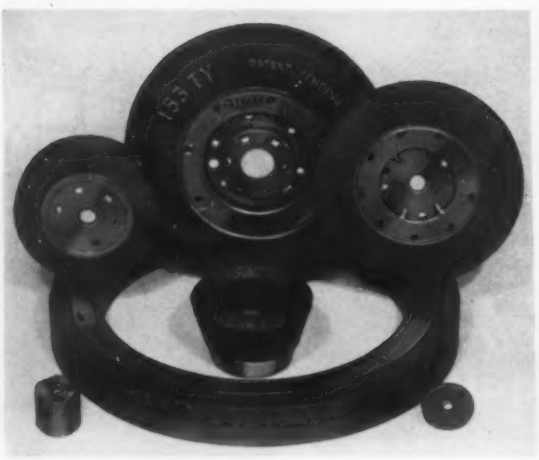
BULLDOZER—for heavy bending and forming. Optional choice of bed size, stroke, and speed.



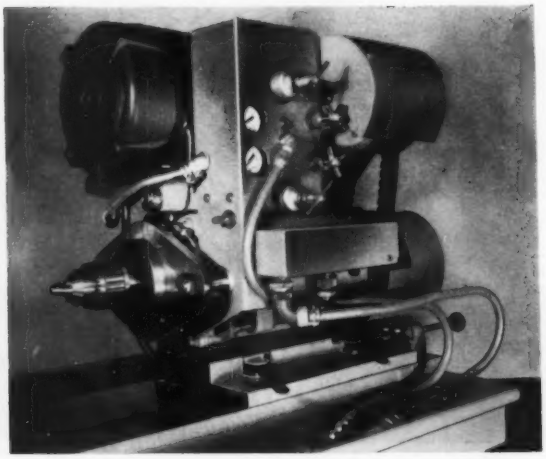
Elmes American Steel Foundries
ENGINEERING DIVISION

1162 Tennessee Avenue, Cincinnati 29, Ohio

METAL-WORKING PRESSES • PLASTICS MOLDING PRESSES • PUMPS • ACCUMULATORS



Power brushes developed by the Osborn Mfg. Co.



Automatic drilling unit made by Batchelder Engineering Co.

the illustration. There are from seven to twenty of these risers per inch. Subsequently, each riser is resistance-welded to the smooth side of the adjacent helix, producing a firm, strong, unitized structure.

To resist corrosion, these filter elements can be made of such material as Inconel, Monel metal, stainless steel, and tantalum. The unitized construction permits use where temperatures vary widely and the element has to expand and contract rapidly—on the order of 300 degrees per second.

The element's trapezoidal design gives a bigger free area and less opportunity for clogging. High volumes of fluids with extremely low differential pressures can be handled. For instance, a unit 5 1/2 inches in diameter and 18 inches long can handle a flow of 2000 gallons of de-aerated and demineralized water per minute, with a degree of filtration of 125 microns at a differential pressure of 1 1/2 psi. Units like these are being used in many nuclear applications.

Circle Item 593 on postcard, page 219

"TY" Tool Line of Power Brushes

The Osborn Mfg. Co., Cleveland, Ohio, has developed a line of power brushes for product- or part-finishing operations such as removing burrs or flash, preparing surfaces for the application of adhesive, blending of junction surfaces, etc. These brushes have been developed especially to perform deburring, finishing, and cleaning jobs beyond the reach of conventional wire brushes, and at the same time provide additional advantages such as greater tool life, greater brushing-action strength, minimum wire breakage, and positive control over area of brush contact.

Circle Item 594 on postcard, page 219

Automatic Drilling Unit

A BECO Model 505 automatic drill unit which provides a wide spindle-speed range (600 to 12,000 rpm with a single-speed motor operating at 1725 rpm) has been announced by the Batchelder Engineering Co., Inc., Springfield, Vt. This unit has stepless speed adjustment over the full speed range. It uses standard dual-voltage, NEMA frame, foot-mounted motors from 1/3 hp up to and including 1 1/2 hp. The one-piece rigid spindle is supported at both ends in a quill which has no splines or slip joints between the spindle bearings. The front quill bearing is adjustable to take up all excess looseness. Relieving type pressure regulators with extremely fine infeed- and retract-speed controls are used. The chuck capacity range is from 0 up to and including 1/2 inch. Strokes are adjustable up to 1 1/2 inches with repeat accuracy on hole depth held within plus or minus 0.002 inch.

This unit is especially adapted for single-point tool hollow milling, end-forming, pointing, and chamfering, as well as drilling and tapping. The tools have a No. 3 Jacobs taper and can be slipped on in place of the drill chuck. The drill unit is supported directly under its center of gravity by a base having a long, longitudinal keyway to insure accurate alignment of unit and work. All electrical and air controls are built in to provide a completely packaged drill unit.

A hydraulic attachment is available to control drill breakthrough. The stroke adjustment of this attachment is not affected by varying the spindle forward-stroke position, and no re-charging gun is necessary. Automatically self-reversing tapping attachments from No. 3 to No. 10 and from No. 10 to 5/16 inch, inclusive, can be supplied. A novel accessory is the BECO Model 503 broken-tool detector, which stops the drill unit in the event of drill or tap breakage. A BECO Model 504 "woodpecker" attachment provides interrupted tool infeed to withdraw chips and cool the tool when drilling deep holes. Infeed interruptions can be timed from the start of spindle advance. This is frequently necessary when the drilling operation is tied in with the automatic work cycling.

Circle Item 595 on postcard, page 219

(*This section continued on page* 202)

introducing a

NEW

OLOFSSON

HEAVY DUTY PRECISION BORING MACHINE

Designed for better precision finishing...semi-finishing...and roughing of large, bulky parts

This newest in the line of Olofsson Precision Boring Machines, the Model 22, is designed for more profitable heavy-duty rough and finishing boring, facing, chamfering, turning and grooving operations. Put one to work . . . and profit potential goes up. Because of the versatility of its new design, operating costs go down.

MODERN, WITH 22 QUALITY-DESIGN FEATURES, the Olofsson Model 22, weighs a hefty 7,600 lbs., untooled; and incorporates such design features as:

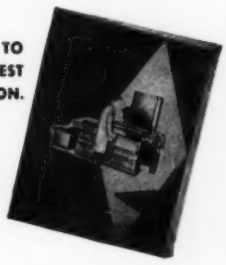
- *Extremely low ratio, height to width, of spindles to ways.*
- *Hardened and ground Alloy Steel flat and vee ways.*
- *Extra-large fixture mounting provides maximum stability for mounting large work pieces.*
- *Integral chip chutes completely surround any fixture tooling.*

WHATEVER YOUR PRODUCTION REQUIREMENTS. IT WILL PAY YOU TO FULLY INVESTIGATE THE MODEL 22. CONTACT YOUR NEAREST OLOFSSON REPRESENTATIVE. Or, if you prefer, write direct to OLOFSSON.

THE OLOFSSON CORPORATION

2729 LYONS AVENUE, LANSING, MICH. Phone: IVanhoe 4-5381

MANUFACTURERS OF PRECISION BORING AND SPECIAL MACHINERY



For more data, circle page number of this ad on inquiry card

Ex-Cell-O Precision Boring Machine Designed for Automatic Operation

A cam-operated precision boring machine that faces both ends of steel gear blanks, chamfers both inside and outside diameters, and generates a radius on the hub faces has been announced by the Ex-Cell-O Corporation, Detroit, Mich. Automatic loading and unloading arms are provided on this machine which pick out and deposit the parts in special chutes.

Fingers located on the loading arm pick three parts from the loading chutes. The arm swings down and loads the parts on expanding arbors. After air-actuated clamping is complete, the arm returns, picks out three more parts, and comes to rest in an upright position. At this point the machine table advances and one tool chamfers the outside diameter, takes a facing cut, generates a 0.030-inch radius, and faces the gear hub. Another tool then performs identical operations on the reverse side of the part, while a third tool chamfers the front inside diameter with a plunge cut.

At the completion of the machining operations, the table retracts and the unloading arm swings down, pulls the parts off the arbors, and deposits them in the unloading chutes. Net production is 315 parts per hour.

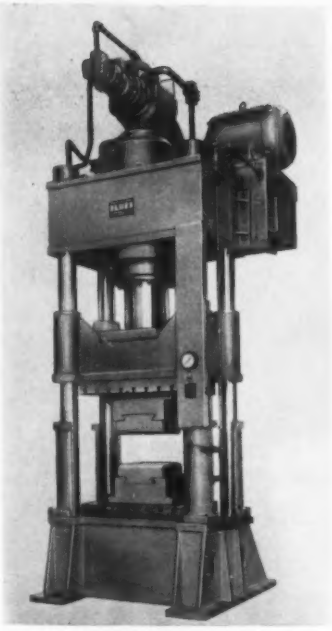
Circle Item 596 on postcard, page 219

Automatic Tracing System that Adapts Milling Machine for Die-Sinking

The True-Trace Sales Corporation, El Monte, Calif., has brought out a "Synchro-Trace" automatic tracing system which is adaptable to all makes of milling machines. With this attachment a milling machine can be used for die-sinking and mold making. The new tracer system allows the milling machine to be used as a conventional mill, with hand or power feed, or as a fully automatic die-sinker. The fully automatic feature is said to save 90 per cent of the operator's time, freeing him for other essential duties.

The cross and longitudinal feeds are infinitely variable from 0.002 to 0.250 inch. Cutter feed is uniform regardless of angle or shape of pattern. Vertical walls can be easily duplicated. The stylus oversize remains constant, regardless of the feed rate. Similar systems, adaptable to lathes, vertical turret lathes, and boring mills, are also available.

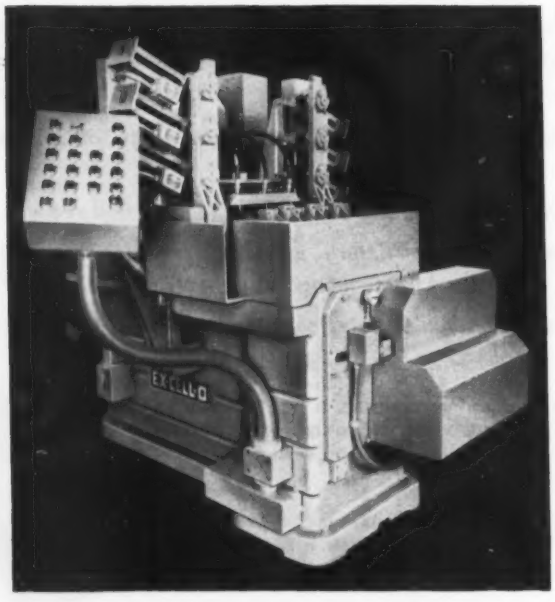
Circle Item 597 on postcard, page 219



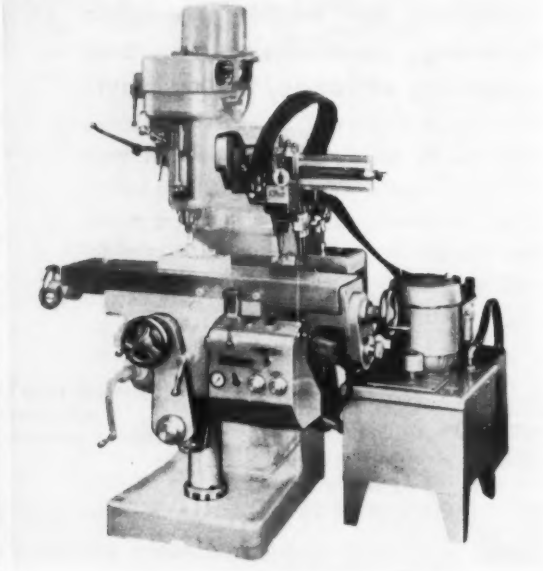
Elmes high-speed press

High-Speed Press for Hot-Forging Operations

An Elmes 500-ton hydraulic press specially designed for high-speed hot-forging operations on both open- and closed-die work has been announced by American Steel Foundries, Elmes Engineering Division, Cincinnati, Ohio.



Ex-Cell-O precision boring machine



Lathe with "Synchro-Trace" System

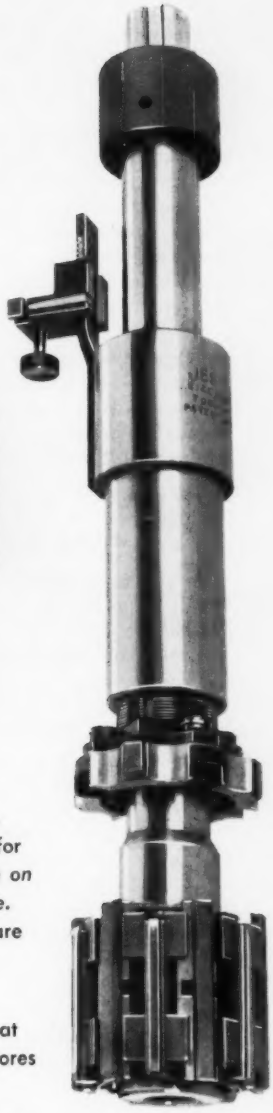
FACTS about

JES-CAL SIZE CONTROL HONING TOOLS

▶ The Jes-Cal honing tool is the most compact, combined hone equipment which has produced uniform size and accuracy consistently and dependably.

▶ Jes-Cal honing tools contain all size control elements. They function independently of the machine, and consistently show overall savings in comparative tooling, machine and operating costs.

▶ The Jes-Cal size control gage, with carbide contact points is long wearing—usually up to one or two years in high production without replacement. It operates entirely independently of friction, it has eliminated all trouble in gaging control.



▶ The Jes-Cal size control taper gage, shown above, is easily and quickly set for pre-selective desired change in final size *on the tool without removal from the spindle.* Adjustment increments of 0.00025-inch are all mechanical—positive—dependable.

▶ Jes-Cal honing tools have been successfully operated in high production at twice former conventional speeds on bores in steel parts.

▶ It has been demonstrated that the full potential advantages of Jes-Cal honing tools cannot be completely developed on most presently used machines; that heavier, all-mechanical machines may be preferable for lower cost production.

▶ For 1960 programs, Jes-Cal is accelerating completion of a much heavier, single spindle, all-mechanically operated honing machine to assure new operating and production advantages.

▶ Jes-Cal honing tools have met—or evidenced their capacity to meet—the requirements desired by leading manufacturers for higher quality, cost-cutting production.

For further information, write to:

SIZE CONTROL JES CAL HONES

JES-CAL COMPANY

31485 GROESBECK HIGHWAY • FRASER, MICHIGAN

For more data, circle page number of this ad on inquiry card

The illustration shows the press with open forging dies in position. T-slots are provided for fastening bolster plates to the slide and press bed. Keyways are cut into the bolsters to facilitate die alignment and to prevent misalignment of dies during forging operations. Long bronze-bushed guides are used on the slide with full tonnage stops around the columns to prevent overstroking of the slide.

The press can be operated by either of two control levers, both serving the same function—one at the press itself and one remotely located. The same control levers are used to obtain short and rapid planishing strokes at full pressure. Speed of operation is under control of the operator at all times, due to proportioning type of pump control. This type of control also enables the operator to set dies without any adjustments or changes in the control system.

The main hydraulic pump is a shifting type, eliminating use of the conventional four-way operating valve. The hydraulic circuit is so arranged that liquid under pressure in the cylinder is partially decompressed before the shift to reversal is made, assuring shockless and quiet operation.

Circle Item 598 on postcard, page 219

Air Gage for Checking Miniature Bearing Races

A quick-responding, highly accurate gage for checking the preload and end play of ball bearings has been announced by the Pratt & Whitney Co., Inc., West Hartford, Conn. This equipment, known as the "Air-O-Limit Preload—End Play" gage, checks both statically and dynamically. It determines the relative "face flushness"—commonly called "stick in" and "stick out"—of miniature and instrument-size ball-bearing races used in aircraft instruments and controls for guided missiles.

The Air-O-Limit principle of measuring back pressure created by restriction of air flow is used to check the position of the inner race relative to the outer race under varying axial loads (preload), and the actual axial displacement of the inner race under load reversal of a given magnitude (end play).

Bearings from 0.040-inch bore through 1-inch outside diameter can be checked to a direct reading of 20 millionths of an inch on the pre-load scale, and 5 ten-thousandths inch on the end-play scale. The heart of the pre-load gage is a combination of free-floating upper and lower pistons which ride in air bearings without friction. The air bearings permit minute axial movements of the bearing inner race under varying pre-loads, to be reproduced faithfully by the pistons and indicated by the sensitive air-gaging circuit. The bearing inner race can be rotated at high speeds. End play is checked by a self-zeroing attachment with a 0.015-inch range Air-O-Limit cartridge.

Circle Item 599 on postcard, page 219

Pratt & Whitney air gage for checking miniature bearing races

Precision boring spindle units manufactured by the Standard Electrical Tool Co.

Precision Boring Spindles

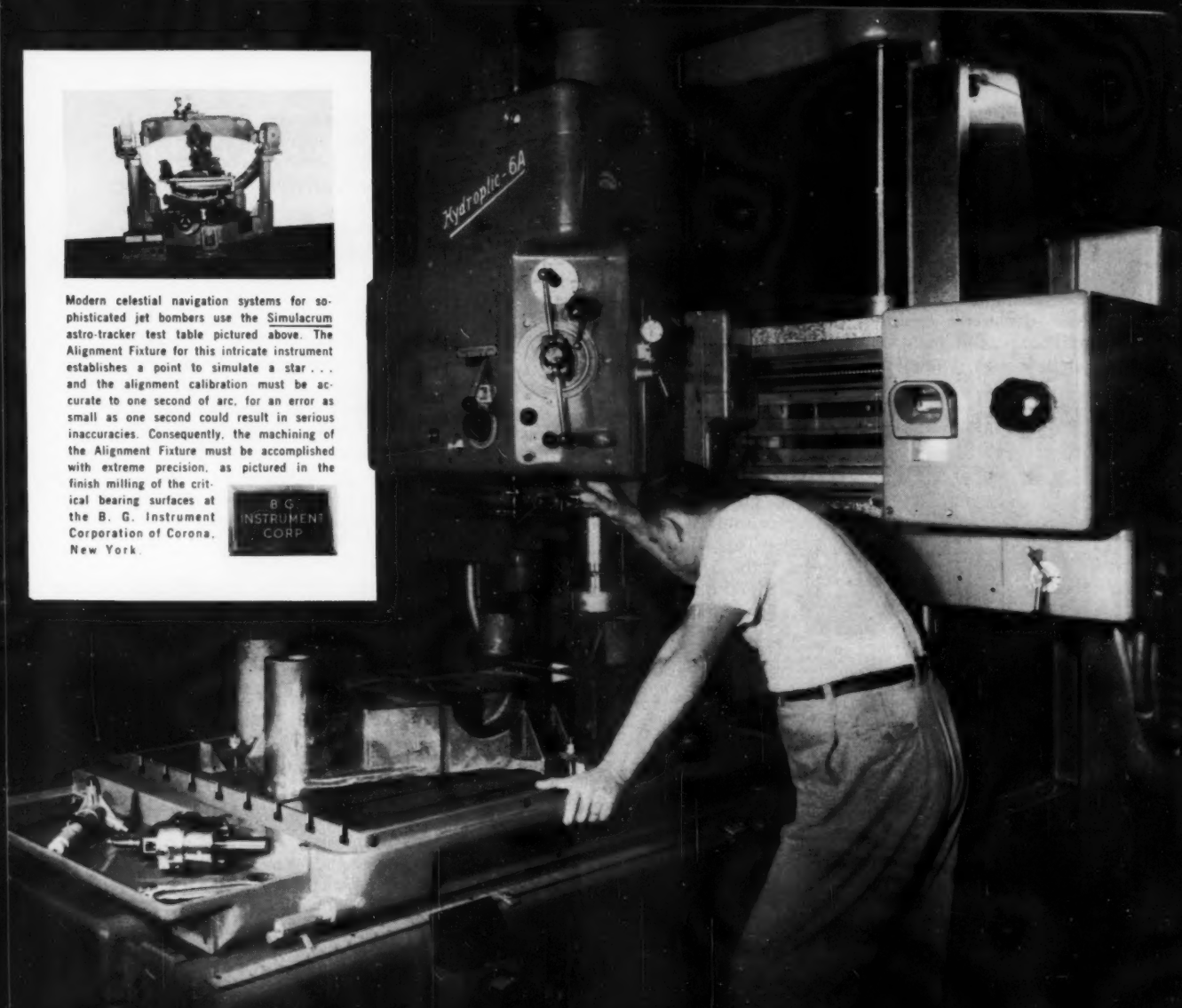
The Standard Electrical Tool Co., Cincinnati, Ohio, is introducing a line of spindle units designed for precision boring operations using conventional boring tools, diamond boring tools, etc. The boring spindle with block type base shown in the upper view is designated No. 4308B. The center view shows the No. 4203B flanged-base spindle while the piggy-back assembly, designated No. 4407B, is shown in the lower view.

These spindles, or the piggy-back assembly, are available in a standard design or custom-built to suit the individual requirement. Each is designed primarily to serve original equipment manufacturers and represents ideal replacement equipment for existing machines. The spindles are permanently lubricated and dynamically balanced.

Circle Item 600 on postcard, page 219

(This section continued on page 206)

Modern celestial navigation systems for sophisticated jet bombers use the Simulacrum astro-tracker test table pictured above. The Alignment Fixture for this intricate instrument establishes a point to simulate a star . . . and the alignment calibration must be accurate to one second of arc, for an error as small as one second could result in serious inaccuracies. Consequently, the machining of the Alignment Fixture must be accomplished with extreme precision, as pictured in the finish milling of the critical bearing surfaces at the B. G. Instrument Corporation of Corona, New York.



SIP

Production with precision

When the job consists of a variety of operations on so critical a part as the Alignment Fixture for the Simulacrum, it is all but mandatory to machine it on the SIP HYDROPTIC. For work of this character, the ultimate in precision is maintained . . . axial centers must be absolutely "dead accurate" (within a tenth) . . . and all bores and locating surfaces must be within an accumulated error not exceeding 0.0005".

Here you see the machining of this Fixture in progress—on the SIP HYDROPTIC 6A Jig Boring and Milling Machine . . . in the temperature-controlled jig boring room of the B. G. Instrument Corporation of Corona, New York.

In the new series of HYDROPTICS . . . featuring greater ease of operation, increased range and capacity, and a guaranteed visual accuracy of 0.00015" . . . the basic Precision that is SIP assures confidence whenever critically accurate machining is demanded. Catalog No. 1149 tells the complete story of the SIP HYDROPTIC 6A; send for it.

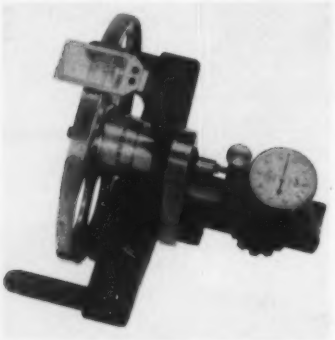
AMERICAN SIP CORPORATION

HIGH PRECISION MACHINE TOOLS & MEASURING EQUIPMENT

100 EAST 42nd STREET, NEW YORK 17, N. Y.

Device for Checking Accuracy of Dial Indicators

A testing device for checking the accuracy of dial indicators has been developed by the B. C. Ames Co., Waltham, Mass. Tested by the U. S. Bureau of Standards, the barrel of the testing device was declared accurate to 30 millionths of an inch. Graduations on its 8-inch diameter ring were



Ames dial-indicator checking device

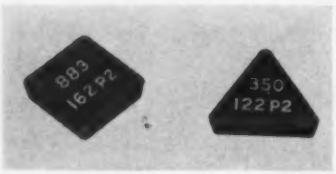
found to be accurate to 2 seconds of an arc of the circumference. The tester proved capable of checking indicators with ranges up to 1 inch direct to 0.0001 inch. The device is light enough to be portable but heavy enough to insure permanent accuracy. The tester has a cast-iron base, with three-point suspension that permits tilting to the proper angle for easy reading.

Circle Item 601 on postcard, page 219

Disposable Metal-Cutting Inserts

The Metallurgical Products Department of the General Electric Co., Detroit, Mich., has announced an addition to its line of disposable Carboloy tool inserts said to cover the largest range available to users of machine tools. Carboloy Grades 78 and 78B are now available through the complete line for general-purpose work, with Grades 330 and 999, for precision finishing.

Ten of the added sizes are completely new—nine sizes in various grades are precision-ground with no radius so that the customer, for economy, can add



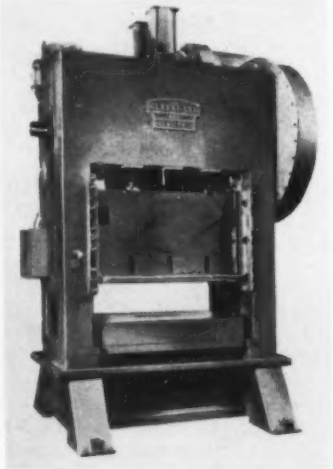
Carboloy inserts introduced by the Metallurgical Products Department, General Electric Co.

the radius to suit any specific job. Inserts with special or non-standard radii are offered in increments of 0.001 up to 0.125 inch at a nominal charge over the cost of the standard inserts. One new size, the 7/16-inch IC triangular insert, is offered in various grades. This addition fills a void between the 3/8- and the 1/2-inch inserts. For quick and easy identification without actual measuring, each Carboloy disposal insert is plainly etched with the grade, size, and type of insert, numbered to conform to industry standards.

Circle Item 602 on postcard, page 219

Cleveland High-Speed Double-Eccentric Press

A versatile, double-eccentric press of 200 tons capacity has been built by the Cleveland Punch & Shear Works Co., Cleveland, Ohio, for a large appliance manufacturer. This press is designed for high-speed, uninterrupted production and can be operated at speeds ranging from

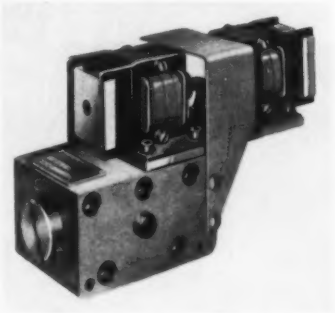


Cleveland double-eccentric press for high-speed production

50 to 150 strokes per minute. It has a bed area of 36 by 54 inches, slide stroke of 4 inches, and a 2-inch adjustment. The distance from bed to slide at the end of the down stroke and with the adjustment up is 20 inches.

The press is of four-piece, tie-rod construction and its power-adjusted slide is air-counterbalanced. Other features are single-end drive and patented, Cleveland drum type friction clutch with electrically controlled spring-loaded brake. All gears and drive mechanism are completely enclosed. An auxiliary air brake on flywheel insures a quick stop.

Circle Item 603 on postcard, page 219



Mighty Midget directional-control valve manufactured by the John S. Barnes Corporation

Four-Way Control Valve

A 1/4-inch, four-way, two-position, detented directional-control valve has been brought out by the John S. Barnes Corporation, Rockford, Ill. This rugged, dual-solenoid-operated, precision-built valve has a body composed of close-grain, electric-furnace iron with a hard nitraloy stem which is ground and lapped to fit. Accurately machined grooves insure positive and consistent results. The continuous-duty solenoids provide smooth, quiet shifting.

The valve is 8 1/8 inches long, 2 3/16 inches wide, and 4 1/2 inches high. It is specially adapted for remotely controlling the direction of flow for hydraulic actuating equipment. Flow capacity is at the rate of 3 1/2 gpm (gallons per minute). Operating pressure is 1000 psi.

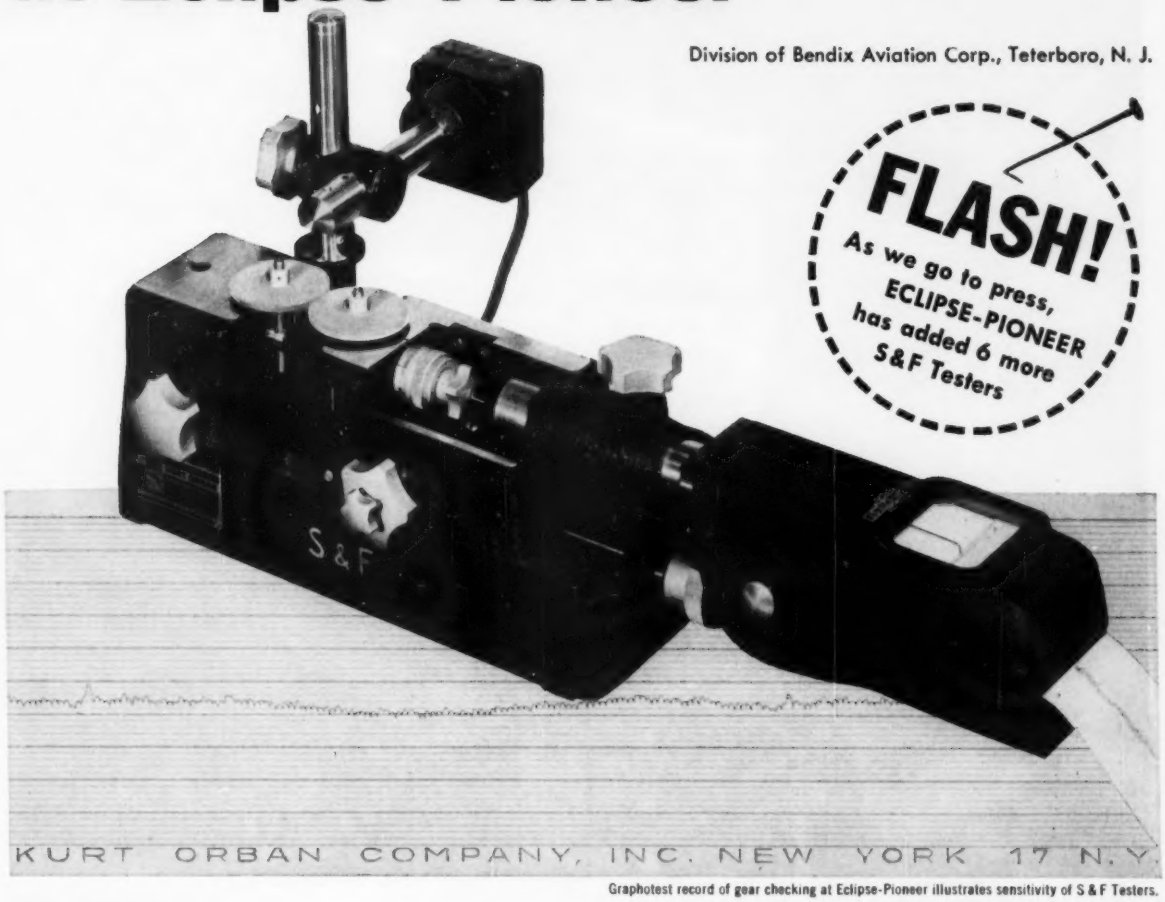
Circle Item 604 on postcard, page 219

(This section continued on page 210)

now it's 13 S&F gear testers at Eclipse-Pioneer

Division of Bendix Aviation Corp., Teterboro, N. J.

FLASH! As we go to press, ECLIPSE-PIONEER has added 6 more S&F Testers



Graphotest record of gear checking at Eclipse-Pioneer illustrates sensitivity of S & F Testers.

because there's no gear tester as accurate as the S & F

Gear specifications for Eclipse-Pioneer's directional gyros call for Precision Class 3 tolerances—tooth-to-tooth error of .0002", total composite error of .0003".

Eclipse-Pioneer found that the S & F provided the *extra* measure of sensitivity which assured that their gear production *really* held to these tolerances. It did the job faster, too. Set-up and change-over time was only a fraction of what it had been with other instruments.

That's why Eclipse-Pioneer recently added three new S & F testers—now has a total of 13 in active operation.

And that's why scores of other plants are changing over to the S & F—to make sure that the gears they make—or buy—are as accurate as they're supposed to be.

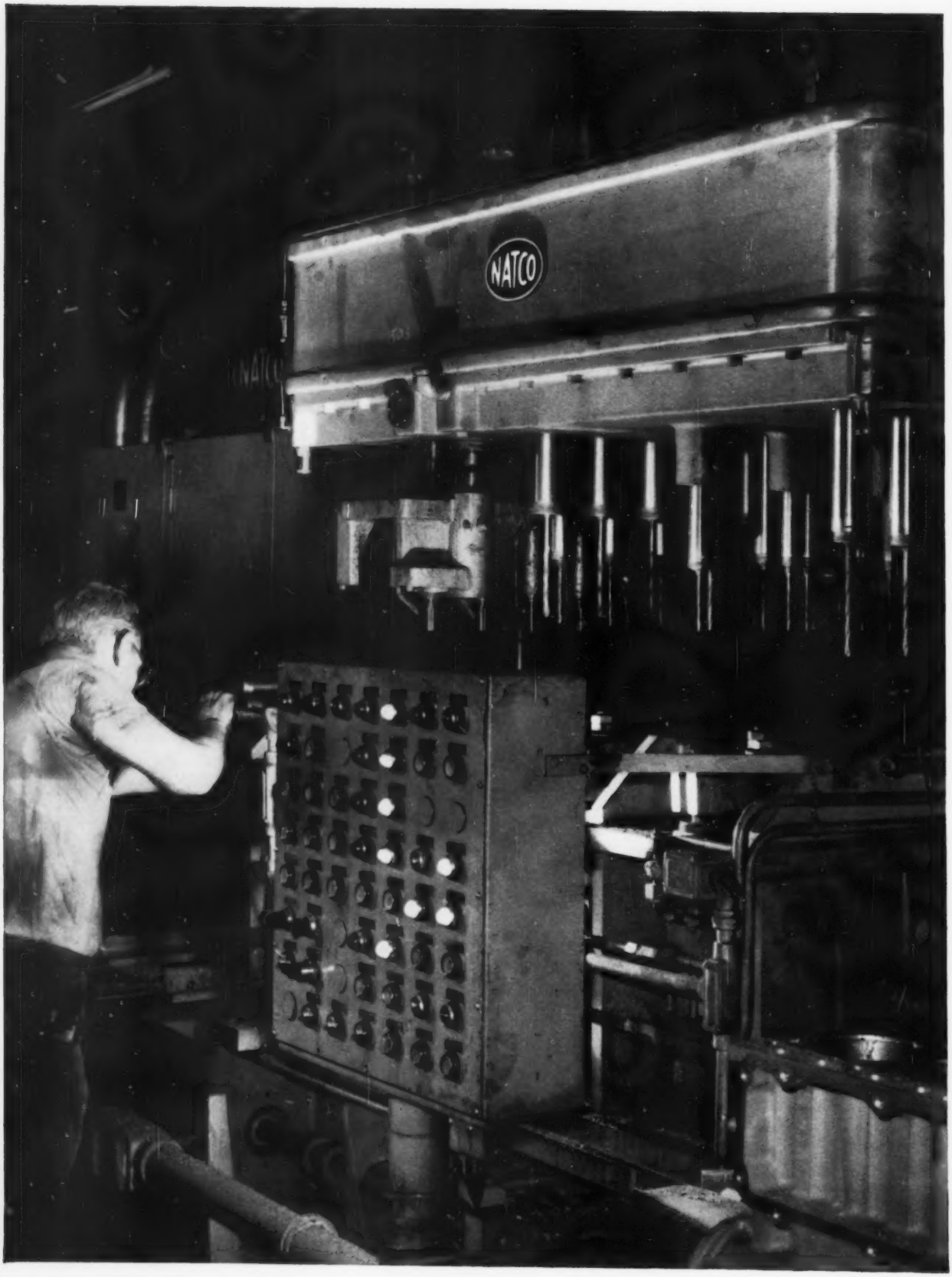
Ask us to show you why the S & F—*guaranteed to repeat within .00001"*—is revolutionizing gear checking. Or talk to the S & F user near you; we'll send you his name.

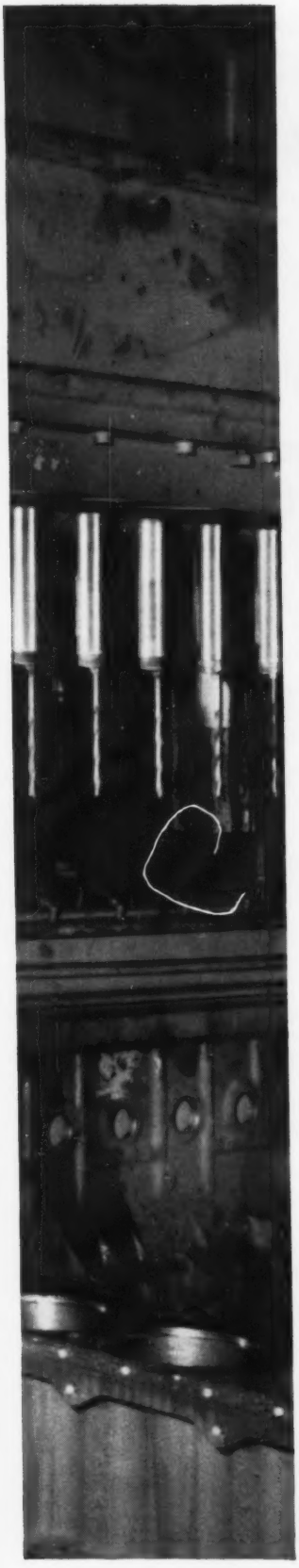
KO CO., INC. PRECISION MACHINERY

KURT ORBAN COMPANY, INC.

42 Exchange Place, Jersey City 2, New Jersey

For more data, circle page number of this ad on inquiry card


NATCO



Unique Natco Transfer Machine

One head does the work of four

New Static Control saves space, maintenance

Although it takes up only 125 sq. ft. of floor space, this Natco performs more than 36 operations per minute!

This unique machine combines four working stations under a single compact head — 32″ x 57″, incorporating 31 spindles. Fixture is Natco 6-station straight line index type. With a part in each station, the following operations are accomplished simultaneously:

Station 1: Load Station 2: Drill 7 holes Station 3: Drill 5 holes Station 4: Chamfer 7 holes, drill 5 holes Station 5: Tap 7 holes Station 6: Unload

Used for the first time in a transfer machine, static controls provide a new degree of reliability. Because there are no moving parts, maintenance is virtually eliminated. And this panel occupies 30% less space than conventional controls require.

Combining operations leads to economy — in this case, saved floor space, easier maintenance and all the advantages automation offers.

Call your nearby Natco representative. He can tell you how a Natco can reduce your costs, improve your methods.

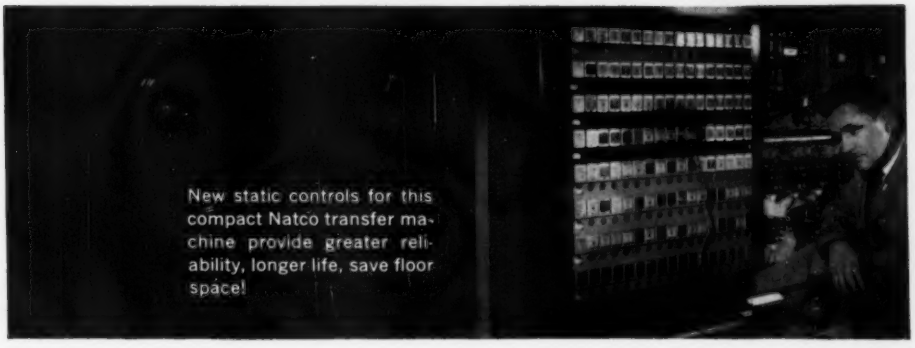
Multiple-spindle drilling, boring, facing and tapping machines. Special machines for automatic production.

NATIONAL AUTOMATIC TOOL COMPANY, INC.

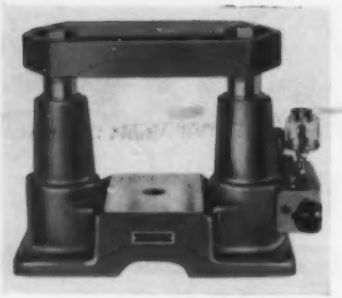
Dept. 305-D, Richmond, Indiana

Natco offices in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles. Distributors in other cities.

NATCO



New static controls for this compact Natco transfer machine provide greater reliability, longer life, save floor space!



Clamp-down type of air-operated jig made by Cleveland Universal Jig Co.

Jigs with Air-Operated Clamps

A line of versatile, air-operated jigs made in four types, each having a large range of sizes, has been announced by the Cleveland Universal Jig Co., Cleveland, Ohio. The "OA" type has two rises—standard and high—to accommodate a large variety of parts. Two types are made to clamp downward by lowering the top plate which is raised or lowered by the plunger movement, and two styles clamp the part upward to the top plate which is stationary.

These jigs are very compact and their operation is practically noiseless, the air exhaust being muffled by a silencer. The speed of the plunger movement can be controlled by two adjusting valves. Seal guards are installed on the plunger to prevent chips and dirt from reaching any moving part. All moving parts are automatically lubricated.

A "Floating" feature is incorporated, which is of great advantage where it is necessary to move the jigs around. Loading and unloading are unobstructed. An air pressure of only 80 psi is required to operate the jigs.

Circle Item 605 on postcard, page 219

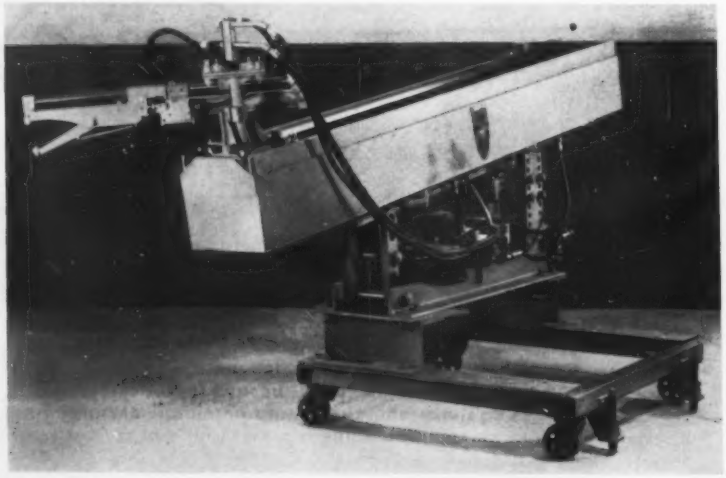
Side-Arm Extractor Added to Line of Sahlin Iron Hand Unloaders

A new side-arm extractor has been added to the line of Iron Hand automatic, press-unloading equipment made by the Sahlin Engineering Co., Inc., Birmingham, Mich. This compact unit has an over-all length that is only 18 inches greater than its stroke of 8 feet. Special design features, including a wheel-mounted portable base, have been developed to give the side-arm extractor great versatility in the pressroom.

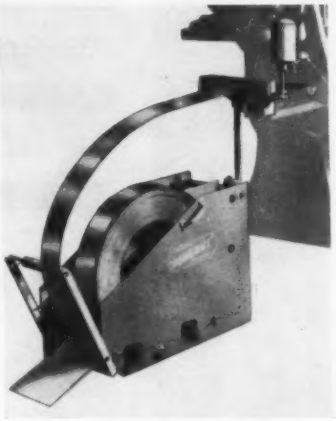
The jaw assembly, a standard Iron Hand jaw, can be moved on the frame so that it can operate on either the left or right side, the controls being centrally located to facilitate this arrangement. The jaw is also adjustable for height and angle of extraction.

Other features include a self-cleaning, angular track which automatically sheds foreign matter, a chain drive, and standard Iron Hand components which can be kept in stock for easy interchangeability. The side-arm extractor is supplied complete with lubricators, pressure regulators, and all electrical controls. Where double dies are used in a large press, two units can be employed, mounted either separately or on a common base.

Circle Item 606 on postcard, page 219



Sahlin Iron Hand press unloader equipped with side-arm extractor



Medelton "Poweroll" coil cradle and "Clean-Oiler" units

Medelton "Poweroll" Coil Cradle and "Clean-Oiler"

"Poweroll" coil cradle and "Clean-Oiler" units announced by the Medelton Co., Inc., Bronx, N. Y., are designed to facilitate automation in the pressroom. The illustration shows these units feeding stock to a power press equipped with an automatic feed and a die which has a built-in scrap chopper. The complete coil cradle and oiler unit occupy a minimum of floor space and can easily be moved from one press to another.

This equipment will handle stock up to 24 inches wide by 48 inches in diameter and up to 3000 pounds in weight. The "Poweroll" coil cradle is so designed that it can be loaded by one man in one minute with little danger of slippage or injury to personnel. The metal coil is simply rolled up the ramp on to the power-driven rollers, eliminating the need for crane or hoist. The combination of "Poweroll" and "Clean-Oiler" feeds material to the operator or to the automatic feed.

Circle Item 607 on postcard, page 219

HOW TIMES AND TOOLS HAVE CHANGED!

IT COST US A NEW CP UNIVERSAL ELECTRIC

TO RETIRE THIS 50 YEAR OLD VETERAN

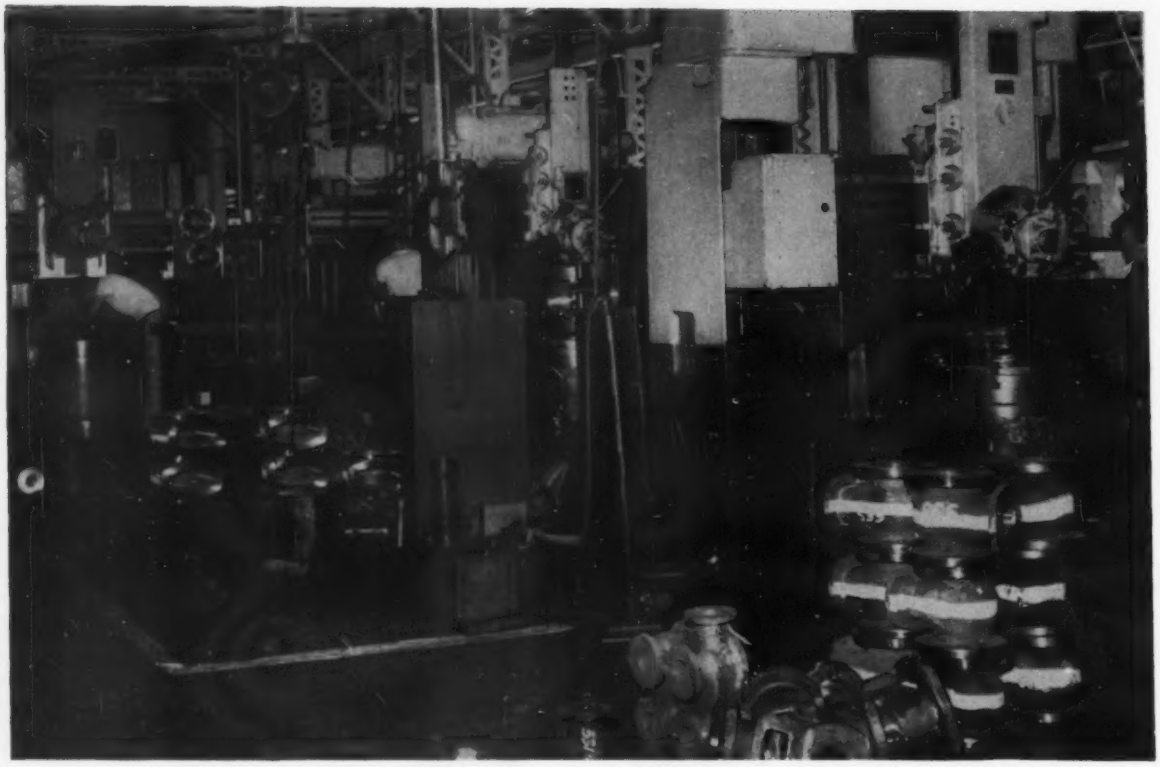
The CP Electric Drill made in 1908 was still on the job until we swapped a brand new CP tool just to get our hands on it. Only the styling has changed. Today the ability of CP Hicycle, Super Cycle and Universal Electrics to perform for a half-century or more remains unchanged! Note how the new CP 903-R Electric Impact Wrench keeps in tune with the times . . . 2″ profile to get into the tight spots dictated to by modern space-saving designs . . . the centered pistol grip with reverse switch in handle for simple, one-hand operation. And the CP 903-R delivers 2000 blows a minute — has built-in bonus capacity, rated for ⅜″ bolt size, handles ⅝″ readily.

Chicago Pneumatic

8 East 44th Street, New York 17, New York

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

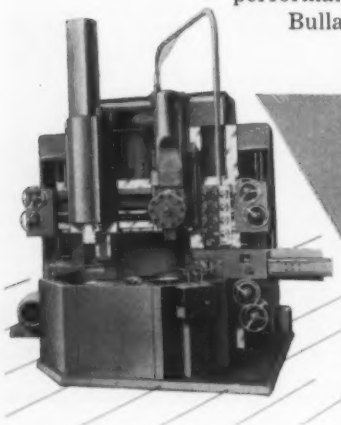
For more data, circle page number of this ad on inquiry card



"they're GOOD machines"

A veteran of 39 years with the Newport News Shipbuilding and Drydock Company, Mr. L. G. Webb, Foreman, further said "a large volume of valve bodies, hubs or levers for hydraulic turbines and various other parts to be machined are handled most efficiently on our Bullard Model 75 Vertical Turret Lathes." Replacing Bullard V.T.L.'s of an earlier design, which gave them excellent performance, this company has a battery of ten Bullard Cut Masters, Model 75, ranging in size from 26" to 66".

BULLARD



The same dependable day-in and day-out cost cutting performance delivered by Bullard Cut Master V.T.L.'s, Model 75, can be applied to your machining work — have a Bullard Sales Engineer show you the many benefits of replacing your outdated equipment.

THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT

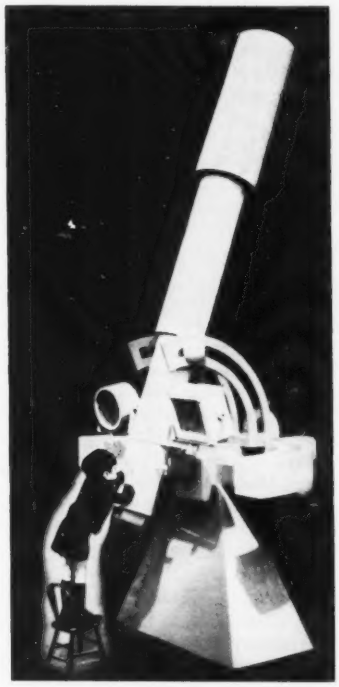
For more data, circle page number of this ad on inquiry card

BETWEEN GRINDS

By E. S. Salichs

Merry Your Christmas, Happy Your Year

That's our Yuletide wish for all of MACHINERY's readers. And may you come out ahead in your struggle to operate junior's atomic submarines, guided missiles, and space rockets!



SANTA HAS HIS PLACE IN SPACE, TOO—Small fry peering into giant telescope can not only see, but converse with, Santa Claus in his workshop at the North Pole. The device, called a Wonderscope, uses a color-sound movie with a baffle speaker and a lip-synchronized hookup, and is intended for shopping centers.

By the Light of the Stars

A new night-vision device using light obtained from the stars has been developed by the United States Army Engineer Research and Development Laboratories and the Radio Corporation of America. It is known as the "Cascaded Photosensitive Image Intensifier." C.P.I.I. (we're sure there'll be an abbreviation of some sort soon!) will enable troops to see military objectives at night which would otherwise be obscured by darkness. Having great regard for Americana, however, we are happy that Francis Scott Key did not have a C.P.I.I. in his pocket, or there would not have been any "dawn's early light."

Innovation for Inquiries

Borrowing from department store charge-account technique (but without the subsequent bills), the Western Tool Show held recently in Los Angeles supplied visitors with metal plates embossed with their names, addresses, and company affiliations. The system saved time and guaranteed accuracy in following up inquiries.

Subtle and Sage

In an item with the heading "Anomaly," published in the *Wall Street Journal*, a Philadelphia advertising agency, Gray & Rogers, sought to demonstrate the negative thinking of companies undergoing minor setbacks. Here it is . . . " 'The wind's falling off. Break out more sail,' said the skipper. 'This is a steep upgrade. Give her the gas,' said the driver. 'Head wind is picking up. Open the throttle,' said the pilot. 'Current's getting stronger. Better shake my tail,' said the salmon. 'Sales are falling off. Curtail the advertising,' said the president."

Taking Labor out of Laboratory

An automated chemistry laboratory, called the "Analmatic," has been built by Baird & Tatlock, Ltd., a British firm, to free scientists from routine analytical work. But too expensive for freeing students, we think, who will have to continue to try for A's without the aid of Analmatic.

What, No Hot Dog?

At the Annual Dinner of the National Machine Tool Builders' Association held recently at Hot Springs, Va., Alfred V. Bodine, president of the Association, sat between men named Sauer and Kraut. The man at his right was Mack Sauer, the guest speaker, and the man at his left was Ralph J. Kraut, president-elect of the Association and president of the Giddings & Lewis Machine Tool Co. It could only happen once in a millenium!

Ghastly Guess

If you own a foreign car, or merely pull up behind one at a gasoline station, this accident reported in the newspapers should keep you alerted. The driver of the foreign car involved told the attendant to "fill 'er up," whereupon the attendant unscrewed a cap at the rear of the car and started pumping gas. Only he wasn't filling the gas tank. It was the burning-hot radiator. The gas exploded and the car caught fire.

News

Illinois and Indiana

LINK-BELT CO., Chicago, Ill., has announced new positions for T. W. MATCHETT, JOHN D. RILEY, HARRY G. ANDERSEN, and HARRY M. HORTON. Mr. Matchett has been appointed assistant general manager of the company's Caldwell plant in Chicago. Mr. Riley succeeds Mr. Matchett as district manager in Chicago. Mr. Andersen has been appointed district manager at Cleveland, succeeding Mr. Riley. Mr. Horton succeeds Mr. Andersen as district manager at Summit, N. J.

DR. ROBERT J. ROHR has been appointed director of research and development of Magnus Chemical Co., Inc., Garwood, N. J. He will have office and laboratory facilities at 2155-57 W. Hubbard St., Chicago, Ill.

C. NELSON WETHERELL has been appointed manager of the Systems and Procedures Division of JOSEPH T. RYERSON & SON, INC., Chicago, Ill. His headquarters continue to be in the general offices of the company in Chicago.

DAVID W. BONNAR has been appointed sales manager of Torc-Pac presses for Clearing Machine Corporation, Chicago, Ill., Division of U. S. Industries, Inc. Mr. Bonnar will be responsible for sales, distribution, dealer training, and promotion of the new presses. Mr. Bonnar was formerly senior sales engineer on major accounts of the Detroit office of Clearing Machine Corporation.

NAVAN PRODUCTS, INC., Los Angeles, Calif., announces that its diatronic diamond cutting wheels will be distributed throughout the world by the DoALL Co., Des Plaines, Ill.

WALTER W. HUTCHINSON has been named sales manager of CULLMAN WHEEL CO., Chicago, Ill., with headquarters at the company's principal facilities at 1344 W. Altgeld St. in Chicago.

GEORGE E. WIND was recently appointed assistant service manager of CLEARING MACHINE CORPORATION, Chicago, Ill., a Division of U.S. Industries, Inc.

LOGANSPORT MACHINE CO., INC. Logansport, Ind., has elected MRS. E. P. WILKINSON, president, to chairman of the board of directors and F. B. WILKINSON, vice-president, to president.

David W. Bonnar, sales manager, small presses, Clearing Machine Corporation

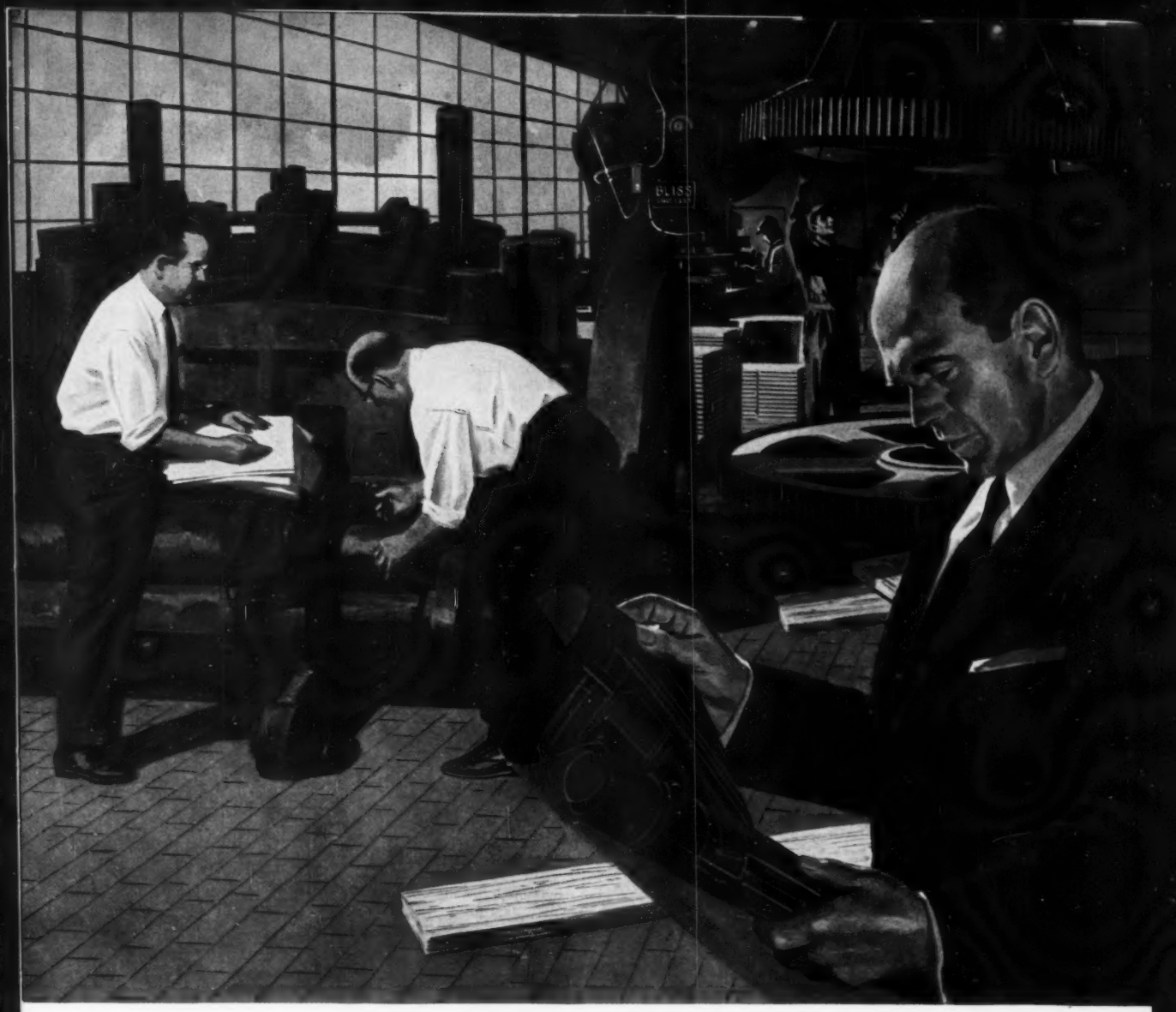
F. B. Wilkinson, recently elected president of the Logansport Machine Co., Inc.

Michigan

TECHLINE DIVISION of WHEELABRATOR CORPORATION, Vicksburg, Mich., announces the appointment of sales representatives. They are CHARLES WILLIAM THOMAS, Arcadia, Calif.; RICHARD DALE TAYLOR, Phoenix, N. Y.; RUEL K. SHUMWAY, St. Louis, Mo.; DONALD H. SCHULTZ, Elm Grove, Wis.; and the INDUSTRIAL SALES AND ENGINEERING CO., INC., Kalamazoo, Mich. Mr. Thomas' territory includes the entire state of California. Mr. Taylor's territory includes the majority of the state of New York, plus thirteen counties in Pennsylvania. Mr. Shumway's territory includes Missouri, Kansas, Arkansas, Oklahoma, and three counties in southwestern Illinois. Mr. Schultz will serve the states of Wisconsin and Minnesota, and Winnebago and Boone Counties in Illinois, through the Eldon Co., Milwaukee, Wis. The lower peninsula of Michigan will be covered by the Industrial Sales and Engineering Co., Inc., Kalamazoo.

MUSKEGON TOOL INDUSTRIES, INC., Muskegon, Mich., a new boring and reaming tool manufacturing firm, has been formed, and has started production of tools similar to those formerly produced in Muskegon by the now defunct Madison Industries, Inc. Heading the new firm is WARREN E. GILL, formerly president of Madison. The other officers, EARL L. PRAIS, vice-president; MRS. WALTER TEICHTHESEN, assistant treasurer; and C. F. LATIMER, secretary, are also former Madison executives.

MICHIGAN TOOL CO., Detroit, Mich., announces that the FUCHS MACHINERY & SUPPLY CO., Omaha, Neb., has been named sales and engineering representative in four mid-western states for the company. Fuchs' territory covers the entire states of Nebraska and Kansas, forty-six counties of Missouri, and nineteen counties of Iowa. Its main business address is 2401 N. Eleventh St., Omaha 2, Neb. A branch office is maintained at 1823 Walnut St., Kansas City 8, Mo.



How to breathe new life into your old presses . . .

Modernize! Replace the old, outdated features on your presses with brand new factory-engineered assemblies. New clutches, new slide adjustments, new bearings—these are only three of the 42 Bliss modernization assemblies you can add right in your own plant, keeping downtime and outside costs to a minimum. You can add important new press features to your old press at a fraction of the cost of a new press!

When modernizing won't do the job . . . consider *rebuilding*. We've rebuilt presses 20 years old and older—*restored them to their original efficiency!* We replace and refit all wearing surfaces . . . replace worn and outdated parts . . . put your press back together to its original tolerances. And we *guarantee* it.

Which is better—to rebuild or modernize? It depends upon the press and what you want it to do. Your local Bliss man will be glad to give you the facts.

BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

BLISS is more than a name . . . it's a guarantee

PRESSES • ROLLING MILLS • ROLLS • DIE SETS • CAN MACHINERY • CONTRACT MFG.

SUNDSTRAND MACHINE TOOL CO., Rockford, Ill., announces the acquisition of all design, manufacturing, and sales rights to the line of Packmaster automatic packaging machinery. Sundstrand-Packmaster machines will be built and sold through Sundstrand's American Broach Division, Ann Arbor, Mich.

BUHR MACHINE TOOL CO., Ann Arbor, Mich., announces the following appointments: EDWARD A. FARWIG as manager of proposals, pricing, and orders; and JOHN HAMAL to represent the company on its complete line of multiple-operation machine tools in northern Ohio and western Pennsylvania.

THE HOOVER BALL & BEARING CO., Ann Arbor, Mich., announces that the company will form Hoover International, Inc., a wholly-owned subsidiary, and has acquired a substantial interest in Nishi Nippon Seiko (NSK) of Otsu, Japan.

W. S. HYLER has been appointed technical assistant to the vice-president–research for HUCK MFG. CO., Detroit, Mich.

STEVEN S. GORDON has been elected president of REPUBLIC GEAR CO., Detroit, Mich.

New England

BROWN & SHARPE MFG. CO., Providence, R. I., announces the following appointments: HERBERT H. UPTON and THOMAS HOLLIS, JR., were elected vice-presidents of the company. Mr. Upton continues in his capacity as general manager of the Hydraulics Division and president of Brown & Sharpe's subsidiary, the Double A Products Co. of Manchester, Mich. Mr. Hollis will also continue in his present capacity as general manager of the Cutting Tool Division and president of another Brown & Sharpe subsidiary, the Nelco Tool Co., Manchester, Conn.

WALTER H. CLEMONS has joined C. I. Hayes, Inc., Cranston, R. I., as a sales engineer.

SACO-LOWELL SHOPS, Boston, Mass., announce the creation of a separate Automotive and Agricultural Parts Division in Saco, Maine. DANIEL O'MADIGAN, JR., has been appointed general sales manager of the division with national sales offices in Detroit. The company has also separated its textile machinery manufacturing into three divisions—textile machinery, replacement parts, and gear and machine. Other segments of the firm are the International Division and the Research Center.

NUCLEAR METALS, INC., Concord, Mass., has announced the dedication of its new $2,000,000 modern functional structure, the largest privately owned metallurgical research and development laboratory in the world.

Nuclear Metals was formed in 1942 as the Metallurgical Project of Massachusetts Institute of Technology and continued under MIT auspices until 1954, when Arthur D. Little, Inc., and Allegheny Ludlum Steel Corporation were selected by the Atomic Energy Commission to continue the activities of the Project.

B. C. AMES CO., Waltham, Mass., has announced the following personnel changes. HENRY G. HAYNES has been named president. BLISS C. AMES was elected vice-president; WARREN AMES, JR., vice-president; and HENRY G. HAYNES, JR., treasurer.

Henry G. Haynes, president, B. C. Ames Co.

CAREY A. EVANS has been appointed manager of engineering for the ELECTRONICS & INSTRUMENTATION DIVISION of Baldwin-Lima-Hamilton Corporation, Waltham, Mass. He will take charge of the Division's testing machine and SR-4 products engineering departments.

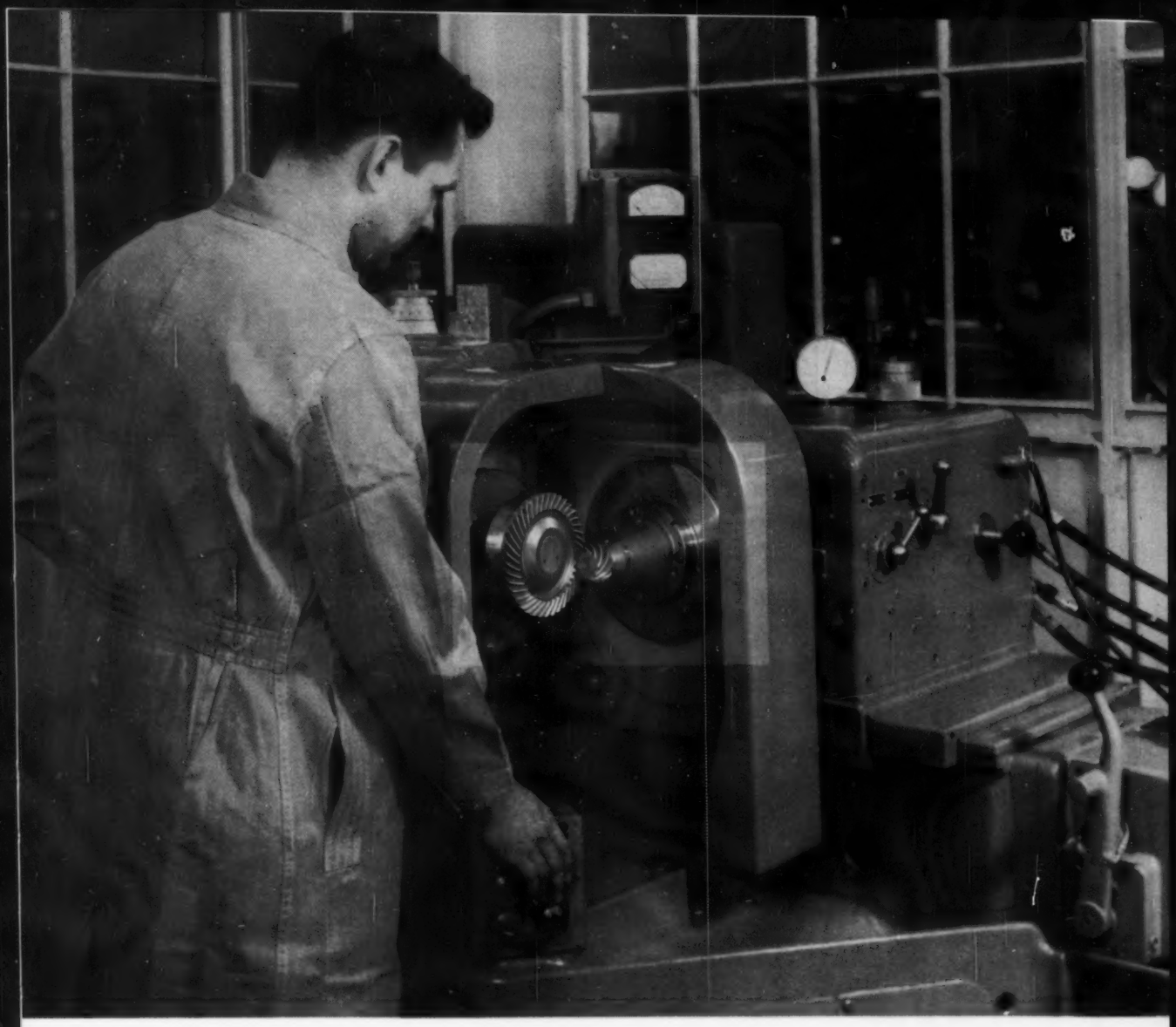
The BARDEN CORPORATION, Danbury, Conn., has opened a new plant for the manufacture of instrument precision ball bearings on Park Avenue, Route 7, in Danbury.

ALLEN MFG. CO., Bloomfield, Conn., announces two new appointments. ELBERT R. FAUST will be

(*Continued on page 224*)

(Left) Herbert H. Upton, vice-president; and (right) Thomas Hollis, Jr., vice-president, Brown & Sharpe Mfg. Co.

Elbert R. Faust, works manager, Allen Mfg. Co.



Now you can *speed-test* gears up to 4000 RPM

Since the accuracy of any gear test depends on how well it simulates actual operating conditions, we've developed a hypoid tester with speeds up to 4000 RPM. The higher range of speed on the No. 17A-4000 Hypoid Tester makes possible a new standard in the testing of bevel gears.

Complete testing on one machine. The No. 17A-4000 Hypoid Tester is arranged for both power and slow rolling tests. With the power test you can observe a gear's smoothness of operation, its noise characteristics, and its tooth contact pattern.

Roll test the gear and you get accurate readings of its eccentricity, tooth size, spacing, and profile.

With the No. 17A-4000 Tester you can test any right angle straight bevel, Zerol® bevel, spiral bevel and hypoid gear of any pitch and up to 20″ OD.

Pre-set backlash control. The No. 17A-4000 Tester has a new hydraulic backlash control mechanism. The control automatically duplicates your pre-set backlash value when you change the relative positions of a gear pair to simulate actual operation.

Exact duplication of settings. Indicator set-up fixtures are available for large quantity testing. With these gages you can make identical settings on a battery of machines, or get the same setting repeatedly on a single machine.

New bulletin. We've prepared a bulletin on the No. 17A-4000 Hypoid Tester to answer any questions you might have about its construction or operation. Write for a copy.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

RB&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

The strength of nuts

With a hard, heat treated nut, ability to plastically adjust and distribute load over many threads diminishes. High loads tend to concentrate on first thread severely enough to cause stripping . . . or fracture of first thread, which causes locking. Nut then cannot increase tension in bolt.

Untreated nuts are strong enough for most needs, and don't pose this problem.

A CAUSE OF STRIPPING

Upon tightening, a nut both compresses and dilates. Dilation can be overcome by wall thickness only, not by added height or heat treatment.

Dilation is important since a reduction in area of bolt under tension accompanies it. Threads pull away from each other, from their stronger base to weaker tips. The shallowness of *fine* threads can cause progressive shear.

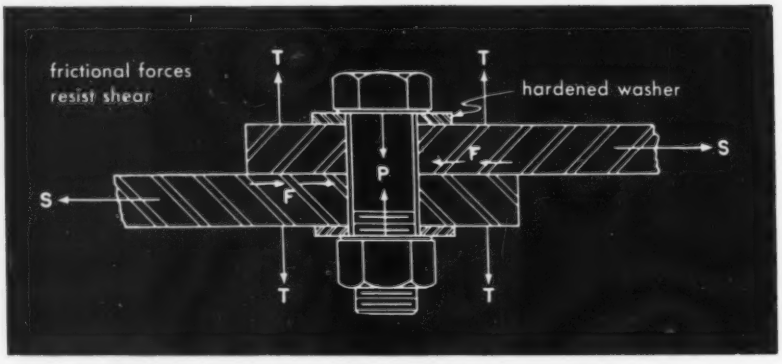
That's why High Nuts (with fine threads) are no answer where "Heavy" Nuts (with coarse threads) are.

WRENCHING STRESS HIGHEST

Rotation of nut produces both tension and torsion in bolt. The force applying this combined stress is about 20% greater than the load which must be sustained when rotation stops.

Thus . . . if a nut hasn't failed in wrenching, it can still withstand at least 20% more direct pull than it sustained during the tightening.

Why high strength bolts make superior joint for dynamic loads



Washers prevent crushing under head and nut with consequent grip relaxation.

While fasteners must be strong enough to carry the calculated loads, what makes a *joint* truly strong is the *residual tension* after wrenching.

NO SLIP OR SEPARATION

Consider the simple lap joint in sketch. Practically rigid, this joint is subjected only to: (1) external tension forces "T" tending to separate the plates against bolt clamping force "P"; (2) shear forces "S" tending to make plates slip against friction resistance "F".

"F" increases when "P" does. With enough clamping force applied, shear loads transfer from one plate to the other without slippage. And when clamping force always exceeds tensile forces, plates obviously *cannot* separate. There can be no further stretch on bolt. Its load stays static at preload "P", even when external loads are dynamic.

UNIFORM CONTROL OF PERFORMANCE

RB&W high strength bolts allow a high magnitude of clamping force to be applied . . . and *uniformly* so. Materials conform to ASTM specifications. Applying known torques to nut produces uniform bolt tensions. Riveting by contrast, depends on difficult-to-control variables.

MORE STRENGTH OVERALL

For shear-resistance, riveted joints offer only the actual rivet shear strength. Don't count too much on friction even though rivets exert some grip as they cool. Compare: a 1-inch bolt tightens to a tension of 42,000 lbs; a 1-inch rivet develops 22,000 lbs at best.

The higher residual tension does more than make a joint much stronger in shear and in tension. It also protects the bolt against fatigue caused by stress-reversing cycles such as vibration; keeps the bolt from loosening, too.

All this explains why, under heavy dynamic loads, rivets can loosen, elongate holes, often fail, requiring difficult replacement; but high strength bolts stand up. They can keep connections permanently tight on vibrating machinery, heavy duty conveyors, and transportation equipment.

Talk it over with an RB&W fastener expert. Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N. Y.

RB&W high strength bolts are from selected grade of medium carbon steel with proper combination of ductility and tensile strength; conform to ASTM A325.

Plants at: Port Chester, N.Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

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NEW CATALOGUES

GRAY-IRON CASTINGS—Ideas covering applications of gray- and ductile-iron castings as developed by design engineers have been collected by gray-iron foundries for their customers in a folder with twenty-six entries to the annual Design Contest of the Gray Iron Founders' Society. The Idea File folders are available to casting users through foundries which are members of the Society.

PRECISION WELDING—Vacuum Tube Products Co., Oceanside, Calif. Catalogue describing its line of precision electronic welding equipment, specially designed to join light-gage materials ranging from 0.003 to 0.080 inches. It may be ordered by writing on company stationery to Vacuum Tube Products Co., 2020 Short St., Oceanside, Calif.

FLARING MACHINE—Automation Associates, Inc., Madison Heights, Mich. Bulletin 581, giving complete description and specifications on their Model C-2 tube flaring machine and Model 2 automation units. Copies are available if requested on company letterhead from Automation Associates, Inc., 1444 E. Eleven Mile Road, Madison Heights, Mich.

PRESSES—Hydraulic Press Mfg. Co., Division of Koehring Co., Mount Gilead, Ohio. Two catalogues illustrating and describing manual and automatic presses. Bulletin 58CPM shows operating characteristics of two new manually controlled "C-Frame" presses. Bulletin 586PA covers four automatic models of the "H-P-M C-Frame" press including automatic, automatic with electrical controls, automatic with hydraulic interlock, and the same with electrical controls. Dimensional data are included. . . . **501**

CEMENTED CARBIDES—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Catalogue, "Cemented Carbides for Industry," including all material that previously had been in five separate Carmet booklets. A new Carmet cutting grade—CA-604—is listed for the first time in any catalogue. It has a new technical section with six special charts on the proper feeds, speeds, and grades of carbide materials to use on various cutting operations. **502**

CUTTING TOOLS—Manco Mfg. Co., Bradley, Ill. Catalogue presenting special-purpose, high-thrust, hydraulic cutting tools, divided into nine sections according to the general types of material to be cut, such as wire and rod, steel billet, strip, bar, tubing, etc. Also included are sections on fabricating, auxiliary power equipment, and optional extra for these hydraulic tools. **503**

SELF-CLINCHING NUTS—Penn Engineering & Mfg. Corporation, Doylestown, Pa. Bulletin SL-858, on the PEM line of all-metal, self-locking, "self-clinching" nuts. It describes these fasteners and explains how they provide load-bearing threads in sheets of aluminum, magnesium, brass, copper, and cold-rolled steel, too thin to thread; and the self-locking function of superior all-metal lock-nuts. **504**

MOTOR CONTROL — Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin No. 14B8192, presenting design and construction features of Allis-Chalmers automatic, reduced voltage starters. Included are motor control engineered for centrifugal compressors, hammer mills, pumps, large conveyors, large fans, motor-generator sets, and other applications. **505**

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STEEL TUBULAR PRODUCTS—Tubular Products Division, Babcock & Wilcox Co., Beaver Falls, Pa. Folder TDC-186, containing ready cross-reference between the type of steel, the application, and the specifications covering the various types of carbon, alloy and stainless-steel tubing, pipe, seamless welding fittings and flanges. ASTM and B&W specifications are given. **506**

PUNCH-CARD CONTROL—The Jordan Co., Inc., Milwaukee, Wis. Bulletin J-200, describing the "One in a Million" Shaftrol positioning gear-motor capable of providing resolution of one part in 1000 for each of its coarse and fine sensors, hence a combined resolution of one part in 1,000,000. .....**507**

BUTT-WELDING RINGS — American Welding & Mfg. Co., Warren, Ohio. Booklet describing how the company produces rings and circular products. Photographs, drawings, and charts illustrate methods used to form bar stock by bending, and how it is welded to produce rings used in aircraft, missile, as well as other industrial applications. **508**

BAND FINISHING — The Carborundum Co., Electro Minerals Division, Niagara Falls, N. Y. Booklet entitled "Tumbling Media for Barrel Finishing," discussing kinds of tumbling media; types of applications; types and functions of tumbling barrels; fixturing and linings for tumbling barrels; analyses of typical tumbling jobs, etc. **509**

FASTENERS—Chandler Products Corporation, Cleveland, Ohio. Bulletin outlining the broad types of precision-engineered fasteners available with special features. It also contains illustrations of cold-forged fasteners produced for the automotive, aircraft, appliance, farm equipment, engine, and other industries. Company offers engineering tests. ..**510**

COIL-SPLICING EQUIPMENT—E. W. Bliss Co., Canton, Ohio. Bulletin No. 43-A, describing its line of Splice-A-Matic welding equipment. Shown are typical arrangements of coil build-up lines, as well as diagrams explaining the principle of Splice-A-Matic welding. Dimensions for all standard models are given. **511**

BACTERICIDE—Eli Lilly & Co., Indianapolis, Ind. Brochure presenting bacterial inhibitor, Elcide 75, which extends the life of soluble oil emulsions as much as five and one-half times that of emulsions with no inhibitor. **512**

SEAM WELDER—Sciaky Bros., Inc., Chicago, Ill. Bulletin 316-7, describing the Sciaky Type MP 1 air-operated, press type, single-phase seam welder designed to cover a wide range of commercial welding applications. **513**

GAS WELDING—Harris Calorific Co., Cleveland, Ohio. Catalogue covering all phases of gas welding and cutting. Included are welding torches and tips, cutting torches and tips, regulators, welding and cutting accessories, and specification sheets to meet all requirements. **514**

DRILL PRESSES—Zagar, Inc., Cleveland, Ohio. Bulletin 858, covering description and application of Models QAR, QEN, and QPL air-oil drill presses. Instructions for machining and assembly of quick-change inserts are given. **515**

TURRET LATHE—Jones & Lamson Machine Co., Springfield, Vt. Catalogue (Form No. LO-5808) presenting information on the company's Ram type turret lathe equipped with Lynn hydraulic drive. Specifications and operating features are given. **516**

STEEL SHEETS—Joseph T. Ryerson & Son, Inc., Chicago, Ill. Revised Bulletin 20-1, listing types of steel sheets and strip available for prompt shipment in the form of coils, stock sizes, and cut-to-order sizes. **517**

SLIDE FEED—U. S. Tool Co., Inc., Ampere (East Orange), N. J. Bulletin No. 151, illustrating and describing their redesigned slide feed. Features include accuracy, durability, and versatility, plus simplicity of setup and adjustment. **518**

PACKAGING MACHINE — Sundstrand Machine Tool Co., Rockford, Ill. Bulletin covering the company's Packmaster Model 50 packaging machine, with automatic hopper installation and pusher feeder, as well as other optional equipment. **519**

LIMIT SWITCH—General Electric Co., Schenectady, N. Y. Bulletin GEA-6861, describing vane-operated limit switch for control of machinery travel and advantages of leverless operation without the attendant cost and application problems of proximity type switches. ...**520**

AIR CYLINDER—The Sheffer Corporation, Cincinnati, Ohio. Bulletin No. 458, presenting a 1 1/8-inch clamp type universal, clevis- or pivot-mounted air cylinder, for tooling, jigs and automation, designated as Series CLA. **521**

ROTARY SURFACE GRINDER — Heald Machine Co., Worcester, Mass. Bulletin 2-161-1, describing the Heald Model 161 rotary surface-grinding machine for precision grinding of flat, concave, and convex surfaces of small work. **522**

HOSE ASSEMBLIES AND COUPLINGS—Eastman Mfg. Co., Manitowoc, Wis. Bul-

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letin 100, describing medium-pressure Eastman hydraulic hose and tube assemblies. It contains accurate dimensional drawings and complete tables of available sizes. **523**

POWER PRESSES—Sales Service Mfg. Co., St. Paul, Minn. Catalogue No. 958, illustrating and describing the complete line of 2- to 85-ton Press-Rite O.B.I. presses with full specifications and detailed descriptions. **524**

GRINDING AND TAPPING—Norton Co., Worcester, Mass. Catalogue detailing facts about Type S-3 6- by 18-inch hydraulic surface grinder, the No. 2 Unitized transfer type crankpin grinder, and the Type CC-8 Crank-O-Matic semi-automatic crankpin grinder. **525**

DRILLS AND REAMERS—Super Tool Co., a division of Van Norman Industries, Detroit, Mich. Catalogue SB-302, covering new solid cemented-carbide miniature drills, reamers, and end-mills in sizes as small as 0.024 inch diameter, to meet numerous aircraft and missile production requirements. **526**

ALLOY-FORM DIES—Dreis & Krump Mfg. Co., Chicago, Ill. Bulletin No. AFD-958, announcing a complete line of dies for bending and forming the various alloy sheets and plates used in aircraft, missiles, rockets, and other fabrications, called Chicago Alloy-Form Dies. . . . **527**

SYNCHRONOUS MOTORS AND CONTROLS—Westinghouse Electric Corporation, Pittsburgh, Pa. Booklet B-7292, "Synchronous Motors and Controls," containing motor selector charts, application data, and formulas for calculating power factor. **528**

TURRET DRILLS—Burg Tool Mfg. Co., Inc., Gardena, Calif. Bulletin illustrating and describing six- and eight-spindle automatic hydraulic turret drills and Burgmaster six- and eight-spindle automatic tape-controlled turret drills, and machine accessories. **529**

UNIVERSAL VISES—Wesson Co., Detroit, Mich. Brochure No. AV-158, covering the company's Model 1A precision universal angle vise. Also covered are specifications on the complete Wesson line of angle vises and angle plates. **530**

GRINDERS—Landis Tool Co., Waynesboro, Pa. Bulletin CD-58, describing the Landis 10-inch, Type DCH and 14-inch, Type LDCH plain cylindrical grinders. Shown is a typical example of how automation can be applied to this grinder, and work setups with an extra-wide wheel or spaced wheels. **531**

LUBRICANT—Universal Lubricants Co., East Lansing, Mich. Bulletin outlining the purpose of "Die Lube Stick," a derivative of metal which contains a new chemical lubricity additive. It is used for eliminating die marks and other imperfections. **532**

DRIVES AND COUPLINGS—Dodge Mfg. Corporation, Mishawaka, Ind. Bulletin A-640B, describing the expanded line of Flexidyne dry fluid drives and couplings. Diagrams, tables, operating advantages, and accessory equipment are covered. **533**

TOOL STEELS—Uddeholm Co. of America, New York City. Chart listing the comparable brand names of thirteen major tool-steel suppliers. It classifies by general type and SAE number sixteen different grades of tool steel. **534**

DRIVER—Dixon Automatic Tool, Inc., Rockford, Ill. Bulletin No. SD-B1, featuring the Dixon driver for screws and nuts, the Auto-Torque Driver. It shows the various models, how parts are handled by the newly developed feeder, and gives specifications. **535**

PAINT STRIPPER—Oakite Products, Inc., New York City. Folder presenting Oakite Stripper S-A for the stripping of epoxy resins, acrylics, vinyls, polyesters, and other hard-to-remove finishes. . . **536**

SHEAR—Whitney Metal Tool Co., Rockford, Ill. Circular describing a lightweight bench shear No. 39 that will cut flats, angle iron, rounds, and bar stock without changing dies or cutting blades. **537**

OPTICAL TOOLING—Engis Equipment Co., Chicago, Ill. Catalogue including descriptions, illustrations, and a comprehensive index in the area of specialized optical tooling and analytical metrology for ready reference by new manufacturers. **538**

SPEED DRIVES—General Electric Co., Schenectady, N. Y. Bulletin GEA-6234B, describing the company's general-purpose Thymotrol adjustable speed drives, 1-hp half-wave and 1- to 4-hp full wave. **539**

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FILTERS—Cuno Engineering Corporation, Meriden, Conn. Catalogue No. 53-101, presenting depth type fiber cartridge filters for full-flow filtration of all types of fluids. **540**

REFRIGERATION—Precise Products Corporation, Racine, Wis. Brochure featuring a new type of cooling system, called Vapor-Lub, for all machining, tapping, drilling, grinding, etc. **541**

HYDRAULIC PRESSES—Hannifin Co., Des Plaines, Ill. Bulletin 130-G, describing a standard line of open-gap and column type high-speed hydraulic presses. **542**

V-BELT DRIVES—B. F. Goodrich Industrial Products Co., Akron, Ohio. Manual, "How to Get Longer Life from V-Belt Drives," telling how to select and install V-belts and how to diagnose and correct belt trouble. **543**

WEATHER-PROTECTED MOTOR—Louis Allis Co., Milwaukee, Wis. Bulletin No. 2550 presenting a line of horizontal, weather-protected motors available in ratings from 250 to 2000 hp. **544**

GENERATOR—Gleason Works, Rochester, N. Y. Folder describing the features, operation, and advantages of the company's No. 114 straight bevel Coniflex generator. Specifications are given. **545**

HORIZONTAL PRESSES—Dake Corporation, Grand Haven, Mich. Catalogue No. 410, featuring the company's line of horizontal presses for extra-long or extra-heavy work. **546**

BRUSH PLATING—Marlane Development Co., Inc., New York City. Booklet entitled "Practical Brush Plating with the DALIC PROCESS," describing in detail numerous engineering applications for high-speed brush plating. **547**

WELDING ELECTRODES—Dobbins Mfg. Co., Cleveland, Ohio. Bulletin containing information about powdered metallurgy as applied to welding electrodes and contacts. **548**

DIAMOND TOOLS—New York Diamond Tool Co., Inc., East Orange, N. J. Catalogue discussing a variety of types of diamond tools, their care and use, and presenting a guide to the selection of diamond sizes. **549**

CONVEYOR BELT—Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J. Bulletin M302, covering a new Ray-Man conveyor belt. **550**

SHEARS—Wysong & Miles, Greensboro, N. C. Catalogue No. AF-109, featuring air- and foot-power squaring shears. **551**

PUNCH PRESSES—Kenco Mfg. Co., Los Angeles, Calif. Bulletins featuring Kenco 15-ton punch press and Kenco 15-ton Electro-Safe punch press. **552**

TWIST DRILLS—Union Twist Drill Co., Athol, Mass. Folder describing straight-shank twist drills made of high-speed steel. **553**

CARBIDE THROWAWAY INSERTS—Pratt & Whitney Co., Inc., West Hartford, Conn. Circular featuring applications of throwaway inserts. **554**

POINTING MACHINE—The Economy Engineering Co., Willoughby, Ohio. Circular describing Type "P" semi-automatic pointing machine and applications. **555**

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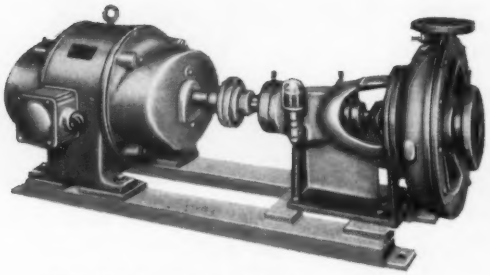
Production-built AMPCO® Pumps, FAFNIR-equipped, do job of costly "specials"

Interchangeable parts cut costs . . . provide unique pump versatility

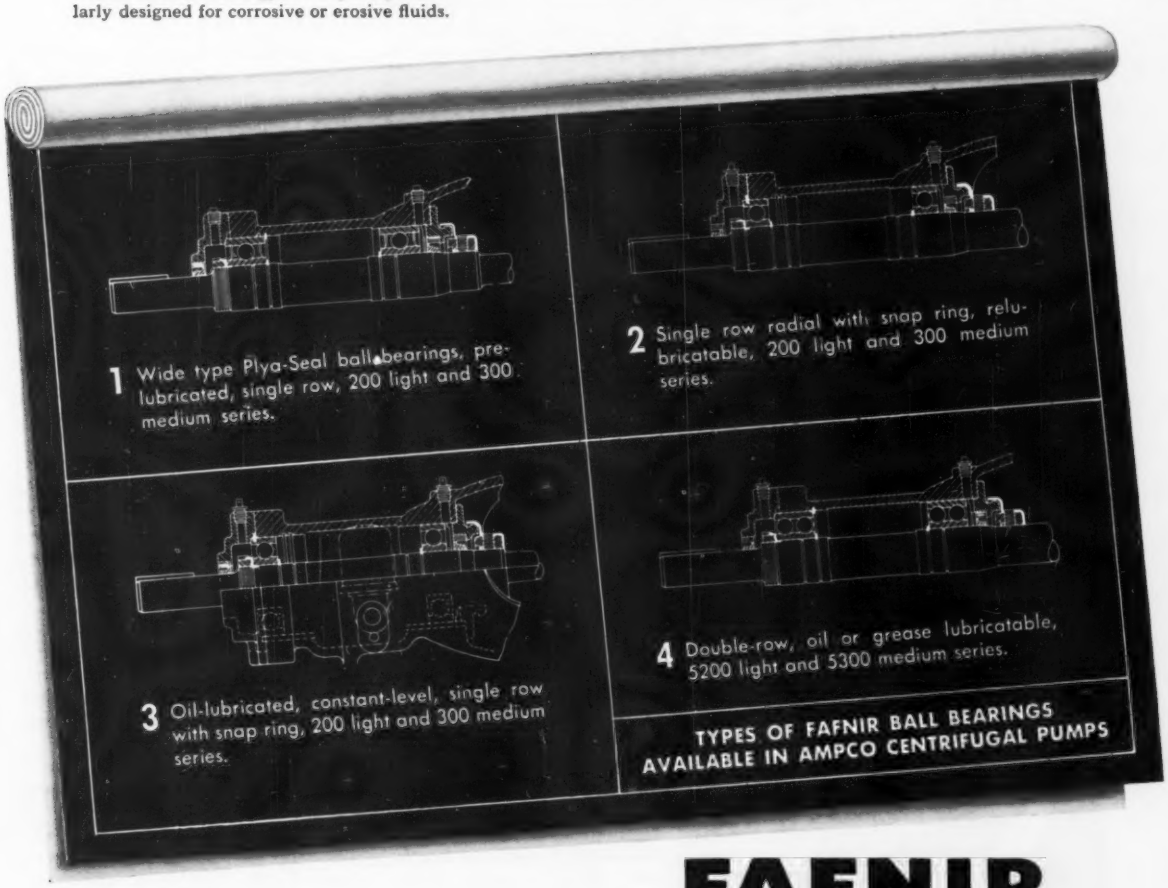


Versatile Ampco single-suction centrifugal pumps are available in sizes ranging from fractional flow to 600 gpm. They are particularly designed for corrosive or erosive fluids.

Centrifugal pumps manufactured with interchangeable parts by Ampco Metal, Inc., of Milwaukee are expressly designed to do jobs that would otherwise call for costly specials. They are also readily adaptable to new pumping requirements.

In designing this versatile pump series, Ampco needed various types of ball bearings. They found Fafnir had "all the answers" — bearings that met diverse size, load, speed, and lubrication requirements precisely.

Chances are, "the most complete line of ball bearings in America" holds the answers to *your* bearing problems. Write The Fafnir Bearing Company, New Britain, Conn.


1 Wide type Plya-Seal ball bearings, pre-lubricated, single row, 200 light and 300 medium series.
2 Single row radial with snap ring, relubricatable, 200 light and 300 medium series.
3 Oil-lubricated, constant-level, single row with snap ring, 200 light and 300 medium series.
4 Double-row, oil or grease lubricatable, 5200 light and 5300 medium series.
TYPES OF FAFNIR BALL BEARINGS AVAILABLE IN AMPCO CENTRIFUGAL PUMPS

FAFNIR
BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

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works manager. SAMUEL W. CHANTLER has been appointed director of research and development.

SKINNER CHUCK CO., New Britain, Conn., has announced two management appointments in its Electric Valve Division: WILLIAM J. BLOUDEK as sales manager and ANDERS ANDERSON as sales office manager. Mr. Bloudek will make his headquarters at the main plant in New Britain.

VEEDER-ROOT INC., Hartford, Conn., announces that HARVEY L. SPAUNBURG was elected chairman of the board and WILBUR C. STAUBLE, president of the company. ANDREW I. REIMANN was elected to the board. ARTHUR E. KALLINICH, vice-president of Veeder-Root, was appointed to the board of the Holo-Krome Screw Corporation, a wholly owned subsidiary of the company.

New York

AIR REDUCTION SALES CO., New York City, announces that R. H. MERRIMAN has been named manager of the company's Buffalo district. F. C. MILLSPAUGH, JR., sales assistant at the Jersey City office, succeeds Mr. Merriman as assistant manager–sales there.

A. SCHRADER'S SON DIVISION of Scovill Mfg. Co., Inc., New York City, has announced the appointment of GARVIN A. DREW as general manager. SELDON T. WILLIAMS has been elected to succeed retiring WILLIAM M. GOSS as president and general manager of Scovill. RUSSELL C. FLOOD was appointed a vice-president. Mr. Flood continues his duties as operations manager.

Garvin A. Drew, general manager, Schrader Division of Scovill Mfg. Co., Inc.

A. MILNE & CO., INC., New York City, has been appointed agent for the new machinable carbide FERRO-TIC (R) produced by the SINTERCAST CORPORATION OF AMERICA. Milne will sell this product in northern Illinois, Massachusetts, New Jersey, Greater New York, Pennsylvania, and West Virginia.

ELMER M. RICHARDSON has been appointed eastern regional manager of the UNION CHAIN & MFG. CO., Sandusky, Ohio. Mr. Richardson will supervise operations of the Boston, New York, and Philadelphia territories, with headquarters in New York City.

BUFFALO FORGE CO., Buffalo, N. Y., announces that EDGAR F. WENDT has retired as president. Mr. Wendt will continue as a director. To succeed him, WILLIAM R. HEATH was elected president.

JOHN R. CASEY has been named manager of User Industries sales for New England by the GENERAL ELECTRIC CO., Schenectady, N. Y. The User Industries sales department is a component of the company's Apparatus Sales Division.

TRIPLEX MACHINE TOOL CORPORATION, New York City, announces the removal of its showroom and demonstration facilities to new quarters at 25-18 43 Ave., Long Island City 1, N. Y.

PHILIP A. ROTH has been elected to the board of directors of U. S. INDUSTRIES, INC., New York City.

Ohio

CLEVELAND CAP SCREW CO., Cleveland, Ohio, announces that FRANK P. BLONSKA has been appointed sales manager, central states. Mr. Blonska will work out of the Cleveland warehouse in Chicago at 133 S. Racine Ave. His territory includes all of Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, North and South Dakota, Montana, Wyoming, Colorado, and the western portion of Michigan.

STANLEY E. CASSON has been appointed director of sales at National Acme Co., Cleveland, Ohio. Mr. Casson has been the company's Detroit area sales manager for twenty-three years.

Stanley E. Casson, director of sales, National Acme Co.

FRANK S. RANZ CO., Cincinnati, Ohio, announces its appointment as exclusive distributor for the Machine Tool Division of the OLOFSSON CORPORATION, Lansing, Mich.

FRED W. ELLIS has been appointed foundry sales representative to the Dayton, Ohio, area for CLIMAX MOLYBDENUM CO., a division of American Metal Climax, Inc., New York City.

WALTER K. BAILEY, president, the WARNER & SWASEY CO., Cleveland, Ohio, was named a member of the Case Institute of Technology Board of Trustees.

KEITH E. CARTER has been made manager of the Toledo sales office of the Reliance Electric & Engineering Co., Cleveland, Ohio. His office is at 1803 Jefferson Ave., in Toledo.

STERLING ELECTRIC MOTORS, Los Angeles, Calif., announce expansion of their plant in Cincinnati, Ohio. The plant and district sales office are located at 4610 Smith Road, that city.

DONALD R. SPOTZ has been elected president and general manager of the Pesco Products Division and Wooster Division, BORG-WARNER CORPORATION, Bedford, Ohio. Mr. Spotz's new duties will include direction and coordination of the activities of all branches of the divisions in Wooster, Ohio; Burbank, Calif.; and Hialeah, Fla.

(*This section continued on page 226*)

V-R Multiple tooling cuts at BOTH 450 and 113 s. f. p. m.

How V-R Carbide and TANTUNG® cast alloy gang up to solve cutting problems

PROBLEM: How to bore 2" I.D. at 113 SFPM while turning 8" O.D. at 450 SFPM.

SOLUTION: A V-R toolholder and throw away insert will perform perfectly on the 450 SFPM O.D. but the 113 SFPM boring speed demands the cutting qualities of V-R TANTUNG cast alloy. TANTUNG is especially engineered for speeds between carbide and High Speed Steel.

V-R Carbide and TANTUNG make a perfect tooling team to solve this and many other cutting problems. Ask your V-R Representative or write for complete information. V-R Engineers will be glad to work with you on all of your cutting problems.

25 YEAR

V-R® **Vascoloy-Ramet corporation**

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CT-702

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(Left) Walter W. Tangemen, director; (center) Frederick V. Geier, chairman; and (right) Swan E. Bergstrom, president, Cincinnati Milling Machine Co.

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio, announces the following changes in management. WALTER W. TANGEMAN, having completed fifty years of service, retired as chairman of the board. He continues as a director. FREDERICK V. GEIER was elected chairman with the responsibilities of chief executive officer. SWAN E. BERGSTROM, who joined the company in 1927, and has served in many capacities, was elected president.

WILLIAM J. STEWART has been elected president of the CLEVELAND PUNCH & SHEAR WORKS CO., Cleveland, Ohio. In his forty years of service at Cleveland Punch & Shear Works, Mr. Stewart has been active in the growth of the metalworking industry. For the past eighteen months, he has been vice-president and general manager.

William J. Stewart, president, the Cleveland Punch & Shear Works Co.

BELLOWS CO., Akron, Ohio, Division of International Basic Economy Corporation, has announced a number of promotions and new assignments of field and engineering personnel. W. C. BUTCHER was promoted to vice-president and general manager of BELLOWS CO. of California and L. A. BOESE was advanced to sales manager of the same company. FRANK V. STAUFFER was assigned to the Cleveland District as manager, and F. L. WALTERS was named Detroit district manager. J. G. MCCOMB has been promoted to assistant chief engineer of HYDRAIR CORPORATION, the Bellows engineering division. L. E. NEAFIE, JR., field engineer, was assigned to the Dayton territory and WILL ROBB was named field engineer in the Cincinnati area. New field engineers appointed are: LOWELL E. ADAIR and DAN OSTROGA for the BELLOWS CO. of California, and DUANE E. HARGREAVES and GEORGE C. ANDERSON, assigned to the Chicago area.

LINCOLN ELECTRIC CO., Cleveland, Ohio, has announced the following changes among its sales engineers: DAVID L. STOCKS has moved to Fresno, Calif. DANIEL E. DOUDNA has opened a new office in Rockford, Ill.

CLIFFORD E. WILLIS, vice-president of Cleveland Pneumatic Industries, Inc., Cleveland, Ohio, has been appointed general manager of Cleveland Pneumatic Tool Division.

LINCOLN ELECTRIC CO., Cleveland, Ohio, has added several sales engineers to its district office organizations. New assignments include DAVID E. READER to Albany, N. Y.; RICHARD T. SCHNEIDER to Cleveland, Ohio; HAROLD W. LEAVENS to Los Angeles, Calif.; RONALD BAUER and HARRISON A. SMITSON to Pittsburgh, Pa.; and DAVID NICHOLAS to Toledo, Ohio.

Herchel M. Richey, vice-president, manufacturing, Roller Bearing and Rock Bit Divisions of the Timken Roller Bearing Co.

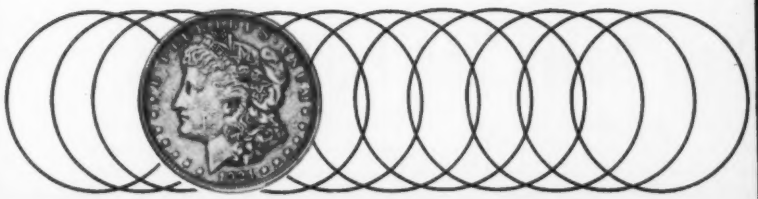
THE TIMKEN ROLLER BEARING CO., Canton, Ohio, announces that HERCHEL M. RICHEY was elected vice-president in charge of manufacturing, Roller Bearing and Rock Bit Divisions. Mr. Richey will replace A. M. DONZE, who retired October 31. Mr. Donze will remain a member of the board of directors.

UNITED STATES DRILL HEAD CO., Cincinnati, Ohio, announces the

CTRONIC ONTROL YSTEMS

LEADERS IN NUMERICAL CONTROL

S-C
STROMBERG-CARLSON



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Lowest cost machine tool contouring system now on the market, both in purchase price and operating expense. Simple to program and operate. Designed for everyday use in the average machine shop to shorten lead times, reduce costs, improve quality and increase output.

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ELECTRONIC CONTROL SYSTEMS
Division of
STROMBERG-CARLSON
DIVISION OF GENERAL DYNAMICS CORPORATION
2231 S Barrington Avenue · Los Angeles 64, California

opening of a new structure which will accommodate the Standard Pattern Division of the company at 5298 River Road, that city. The new plant is supervised by John Lang, vice-president, and general manager of this division.

Pennsylvania

BIRDSBORO STEEL FOUNDRY & MACHINE CO., Birdsboro, Pa., has appointed RALPH WILSON BROWN of Pittsburgh, Pa., as railway and industrial sales engineer. Mr. Brown will represent Birdsboro in Baltimore, Philadelphia, and the eastern United States. ROBERT V. SIMPSON has joined the company as railway and industrial sales engineer. He will cover railways and industrial accounts in Baltimore, Washington, and points south.

PHILIP W. SCOTT has been elected a group vice-president of the BUDD CO., Philadelphia, Pa., with supervision over four of the company's divisions. Mr. Scott will be a member of the Budd Policy Committee in addition to having direct responsibility for the operations of the NUCLEAR SYSTEMS DIVISION; CONTINENTAL DIAMOND FIBRE CORPORATION; TATNALL MEASURING SYSTEMS CO.; and KROUSE TESTING MACHINE CO., the latter three wholly owned Budd subsidiaries.

PHILADELPHIA GEAR CORPORATION, Philadelphia, Pa., has signed an agreement with Maag Gear-Wheel Co. Ltd., Zurich, Switzerland, which will make available in this country Swiss-designed industrial gears providing precision tolerances not possible with American equipment. The agreement names Philadelphia Gear as exclusive agent for the manufacture and sale of Maag gear products in the United States and its territories.

"DICK" LABUS has joined Atkins Saw Division of BORG-WARNER CORPORATION, Indianapolis, Ind., as sales representative for eastern Pennsylvania, southern New Jersey, Delaware, Maryland, and Washington, D. C. His headquarters will be in Philadelphia.

JOHN A. MAHONEY, JR., has been appointed sales engineer by the Pangborn Corporation, Hagerstown, Md. Mr. Mahoney will have his headquarters at the Philadelphia district office of the company at 806 West Ave., Jenkintown, Pa.

JOHN W. PETERSON has been appointed a field engineer for NORTON CO., Worcester, Mass., at its Philadelphia district office.

R. T. EAKIN has been appointed vice-president of operations of the LATROBE STEEL CO., Latrobe. Pa.

Texas and Alabama

FELTON H. HAVINS has been named director of sales—engineering for ANADITE INC. OF TEXAS, Hurst, Texas.

MICHIGAN TOOL CO., Detroit, Mich., announces that the SHOP SUPPLY CO., Birmingham, Ala., has been named sales and engineering representative for the company in four southern states. The sales firm will also represent Michigan's Gear-O-Mation Division. Business address of Shop Supply is 2920 1/2 S. 18 St., Birmingham 9, Ala. The firm's territory covers the entire state of Alabama, ten counties in Florida, thirty counties of Mississippi, and sixty-one counties in Tennessee.

Wisconsin and Missouri

B. L. MONTAGUE CO., INC., East Liberty St., Sumter, S. C., has been appointed sales agent and distributor for the INDUSTRIAL PRODUCTS DIVISION of WARNER ELECTRIC BRAKE & CLUTCH CO., Beloit, Wis. CROSS SALES & ENGINEERING CO., Greensboro, N. C., has been appointed sales agent and distributor for this Division. The Cross organization will supervise Warner's sales and service activities in North Carolina, western Virginia, and southern West Virginia.

KENNETH P. MARTIN has been made industrial sales manager, SUNNEN PRODUCTS CO., St. Louis, Mo.

New Books and Publications

ENGINEERING PROPERTIES AND APPLICATONS OF PLASTICS. By Gilbert Ford Kinney. 278 pages, 6 by 9 inches; 65 illustrations; 12 tables. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y. Price, $6.75.

After an introductory chapter which tells what plastics are, gives their advantages and disadvantages and some figures on production, the book goes into a detailed description of various plastics. These descriptions provide the reader with good background information for the proper utilization or specification of these materials. Other chapters in the book go into the engineering, thermal, optical, and electrical properties of plastics, as well as their chemistry, and molding methods used.

Plastic materials covered by chapters include: polyethylene; polyvinyl chloride; polystyrene; acrylic plastics; other vinyl type plastics; cellulose plastics; phenolic plastics; amino plastics; polyesters, polyamides and epoxies; and silicones and rubbers.

TOOLING FOR METAL POWDER PARTS. Prepared by George H. De Groat under the auspices of the American Society of Tool Engineers. 256 pages, 6 by 9 inches, illustrated. Published by McGraw-Hill Book Co., 327 W. 41st St., New York 36, N. Y. Price, $7.50.

The latest practical developments in the production of metal powder parts are treated in this manual. Emphasis is placed on planning and tooling for structural parts, such as cams, gears, latches, etc. The book outlines the entire process with information on its advantages and limitations, comparison with other processes, and case histories illustrating the necessary planning and economics.

Special attention has been given to the design of briquetting tools, with numerous illustrations of tools taken from actual practice. Sintering the briquetted parts is treated, including descriptions of various types of furnaces and protective atmospheres.

Many line drawings illustrating tool and part design show the significant details in both these areas of the process. The book also features a useful glossary of terms and a broad bibliography.

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Annual Index to MACHINERY

The annual index to Volume 64 of MACHINERY (September 1957 to August 1958 inclusive) is now ready for distribution. Subscribers who have not previously requested copies can obtain them without charge by writing to MACHINERY, Circulation Department, 93 Worth St., New York 13, N. Y.

WHEN "SECONDS" COUNT...

GO MIKRON

No. 132-01 MIKRON

Spur Gear Hobbing Machine with 15-Second Spacing Accuracy

The "DIFFERENTIAL" between an ordinary gear hobbing machine and a MIKRON is...

MIKRON QUALITY

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Obituary

VICTOR F. STINE, president of the Pangborn Corporation, Hagerstown, Md., died October 29 at the age of sixty-five. Well known in the foundry and metalworking industry, he received many honors during his business career. Mr. Stine served his company in sales and many administrative capacities from 1912 to his death. He was elevated to the presidency two years ago.

Coming Events

DECEMBER 1-5—Twenty-Third Exposition of Power and Mechanical Engineering will be held at the Coliseum, New York City. For further information, contact International Exposition Co., 480 Lexington Ave., New York 17, N. Y. E. K. Stevens, manager.

JANUARY 12-16—Annual Meeting and Engineering Display, Society of Automotive Engineers, at the Sheraton-Cadillac and Hotel Statler, Detroit, Mich. Contact Robert W. Crory, Public Relations Manager, SAE, 485 Lexington Ave., New York 17, N. Y.

MARCH 16-20—Western Metal Show to be held at Pan-Pacific Auditorium, Los Angeles, Calif. Contact American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

MARCH 19-20—National Production Meeting, Society of Automotive Engineers, to be held at the Sheraton-Cadillac, Detroit, Mich. Contact Robert W. Crory, Public Relations Manager, SAE, 485 Lexington Ave., New York 17, N. Y.

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Traveling Science Library for High Schools

During the current school year, the American Association for the Advancement of Science and the National Science Foundation, in cooperation with book publishers, will provide about 1400 senior high schools with 350 "circulating libraries" of 200 carefully selected science books. The Foundation, an independent agency of the Federal Government, announced a grant of $500,000 to support the Traveling High School Science Library Program for the fourth year.

During its first year of operation under AAAS sponsorship, the Traveling Science Library circulated eleven sets of 150 books to 66 senior high schools. Books are rotated to permit each school to use one entire set during the year. Last year the demand was so great that the AAAS could honor only a fraction of the applications received. This year, fifty books will be sent at a time, with an exchange being made approximately every two months.

• • •

American Standard for Diamond Dressing Tools

An American Standard covering classification, designation, definition, and shank-dimension tolerances of diamond tools used for dressing or truing grinding wheels has been announced by the American Society of Tool Engineers. Officially known as "Diamond Dressing Tools, B67.1-1958," the new standard, which is the result of a six-year cooperative effort by the Society and the Industrial Diamond Association of America, is expected to provide a working guide for all who use or make diamond tools.

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Atomic Energy Research Report

A free price list of more than 4000 unclassified research reports of the Atomic Energy Commission, for sale by the Office of Technical Services, is available on request. To obtain the list (issued semi-annually), request AEC Research Reports Price List No. 30 from OTS, U. S. Department of Commerce, Washington 25, D. C.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (TITLE 39, UNITED STATES CODE, SECTION 233) SHOWING THE OWNERSHIP AND MANAGEMENT

of MACHINERY, published monthly at Bristol, Conn., for October 1, 1958.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 93 Worth St., New York 13, N. Y.; Editor, Charles O. Herb; Managing Editor, Charles H. Wick; Business Managers, Robert B. Luchars, Edgar A. Becker, and Harold L. Gray. The address of all the foregoing is 93 Worth St., New York 13, N. Y.

2. The owners of 1 per cent or more of the total amount of stock are: The Industrial Press, Robert B. Luchars, Edgar A. Becker, Franklin D. Jones, Walter E. Robinson, Charles O. Herb, Harold L. Gray, Clifford Strock, and Suno E. Larson, all of 93 Worth St., New York 13, N. Y.; Helena E. Oberg, 65 Eighty-second St., Brooklyn 9, N. Y.; Edgar L. Becker, Nominee for Nancy Jane Becke., Susan Louise Becker, and Donald Louis Becker, 714 Wellington Road, Ridgewood, N. J.; Montclair National Bank and Trust Co. and Robert B. Luchars, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; Montclair National Bank & Trust Co. and Kenneth D. Ketchum, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; David D. Ketchum, 38 Mill Road, Falmouth, Mass.; Lee W. Noyes, Guardian for Susan Yarnall Urban, Greensboro, Vt.; Lee W. Noyes, Trustee under the Will of Robert L. Urban, Greensboro, Vt.; and John T. Urban, 8 Craigie Circle, Cambridge 38, Mass.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: Dorothy B. Baldwin, 420 Clinton Ave., Brooklyn 38, N. Y.; Robert B. Luchars, 93 Worth St., New York 13, N. Y.; Franklin D. Jones, 14 Washington Place East, New York 3, N. Y.; Ann Pelletier, 116 Pinehurst Ave., New York 33, N. Y.; Elizabeth Y. Urban, 38 Lakeview Road, Asheville, N. C.; Helen L. Ketchum, 231 King St., Cohasset, Mass.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; and Henry V. Oberg, 6825 Almansa St., Coral Gables, Fla.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

EDGAR A. BECKER, Business Manager

Sworn to and subscribed before me this 19th day of September, 1958. (SEAL).

ALEXANDER LOYKA

Notary Public, State of New York
No. 31-7611350
Qualified in New York County
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Positive Protection Against Phase Failure and Phase Reversal ?

Here is your answer!

The Allen-Bradley Bulletin 812 Type F, Type R, and Type RF relays provide positive protection against the hazards to men, motors, and driven machinery, resulting from phase failure and/or phase reversals.

The Bulletin 812 Style F phase failure relay employs a unique static sensing network that responds to all open phase conditions on a motor branch circuit and immediately removes the motor from the line . . . irrespective of the load on the motor (including no load), or the circuit arrangement. This relay even responds to hard-to-detect primary failures on a wye-delta transformer with ungrounded neutral. Furthermore, the five-cycle response prevents nuisance "drop-outs" from transient fluctuations.

The Bulletin 812 Style R phase reversal relay disconnects the motor from the line—whether it is running or not—when a phase reversal occurs anywhere in the system on the line side of the relay. Thus, it can be employed for a single motor, a group of motors, or an entire power system. In addition, the phase reversal relay prevents the motor from starting should phase failure occur while at a standstill—a vital feature for elevator applications.

The Bulletin 812 Style RF relay combines the elements of Style R and Style F relays for protection against both phase failure and phase reversal. All Bulletin 812 relays are inherently "fail safe." Send for complete information.

Allen-Bradley Co., 1316 S. Second St.
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In Canada: Allen-Bradley Canada Ltd.
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MOTOR CONTROL

12-58-MR

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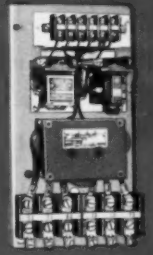
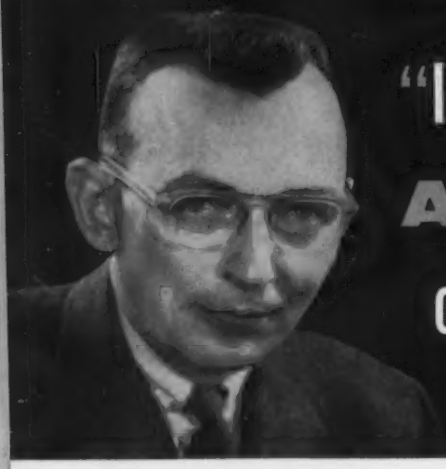
For Phase Failure



Style F covers full load currents from 1.5 to 300 amp in 4 sizes. Coils for up to 600 v, 60 cycles.

For Phase Reversal

Style R made with coils for 110, 208/220, 440, 550 v for either 50 or 60 cycle operation.



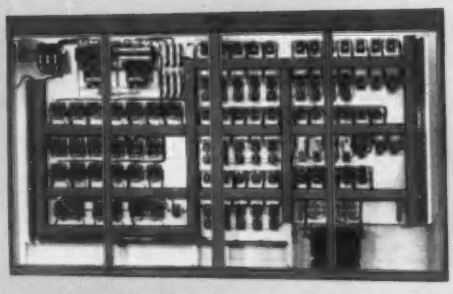
"If we stick to ALLEN-BRADLEY... our control troubles evaporate"

...so says John A. Bradner,
President, Lees-Bradner Co.,
Cleveland, Ohio, machine tool manufacturer.

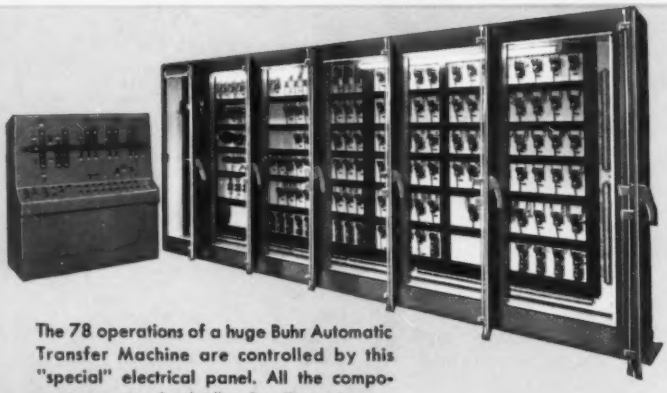
"Yes, we have chosen Allen-Bradley controls. We use them, like them, and most thoroughly approve of them. We do our level best to see that they're the ones with which LEES-BRADNER machines are equipped.

"It has been our experience in over 25 years of pioneering electrical rather than mechanical control of machine tools that, if we stick to Allen-Bradley, control troubles we are too apt to have otherwise—*evaporate!*"

Lees-Bradner Gear Hobbing Machine, above, uses six motor control panels assembled from standard A-B components.



This is the electrical control panel for a 12-station Kingsbury Indexing Automatic which performs 19 operations on an automatic transmission part. All the components in this panel are standard A-B control items.



The 78 operations of a huge Buhr Automatic Transfer Machine are controlled by this "special" electrical panel. All the components are standard Allen-Bradley units.

A-B QUALITY

ALLEN-BRADLEY

MOTOR CONTROL

QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

12-58-R

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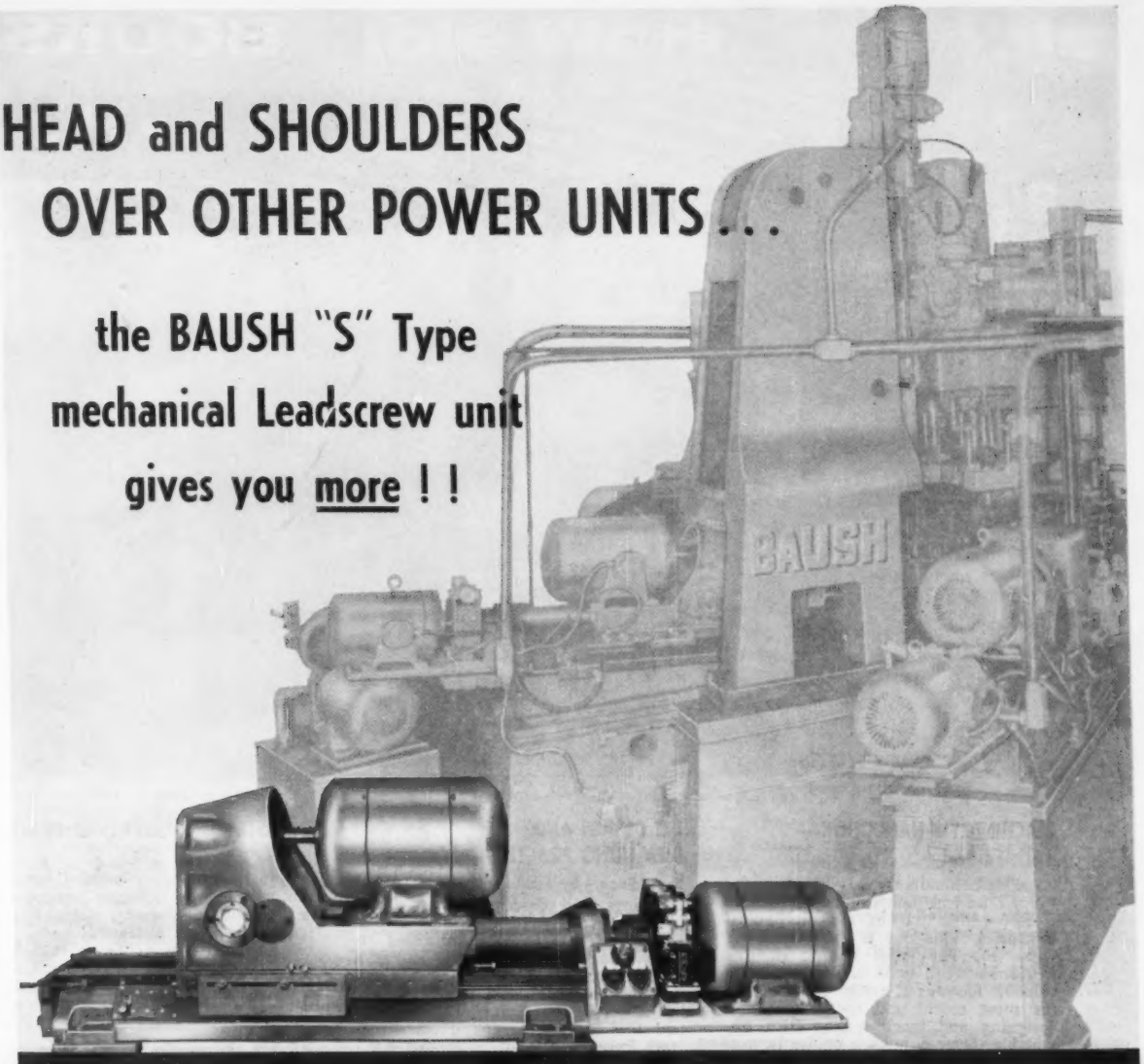

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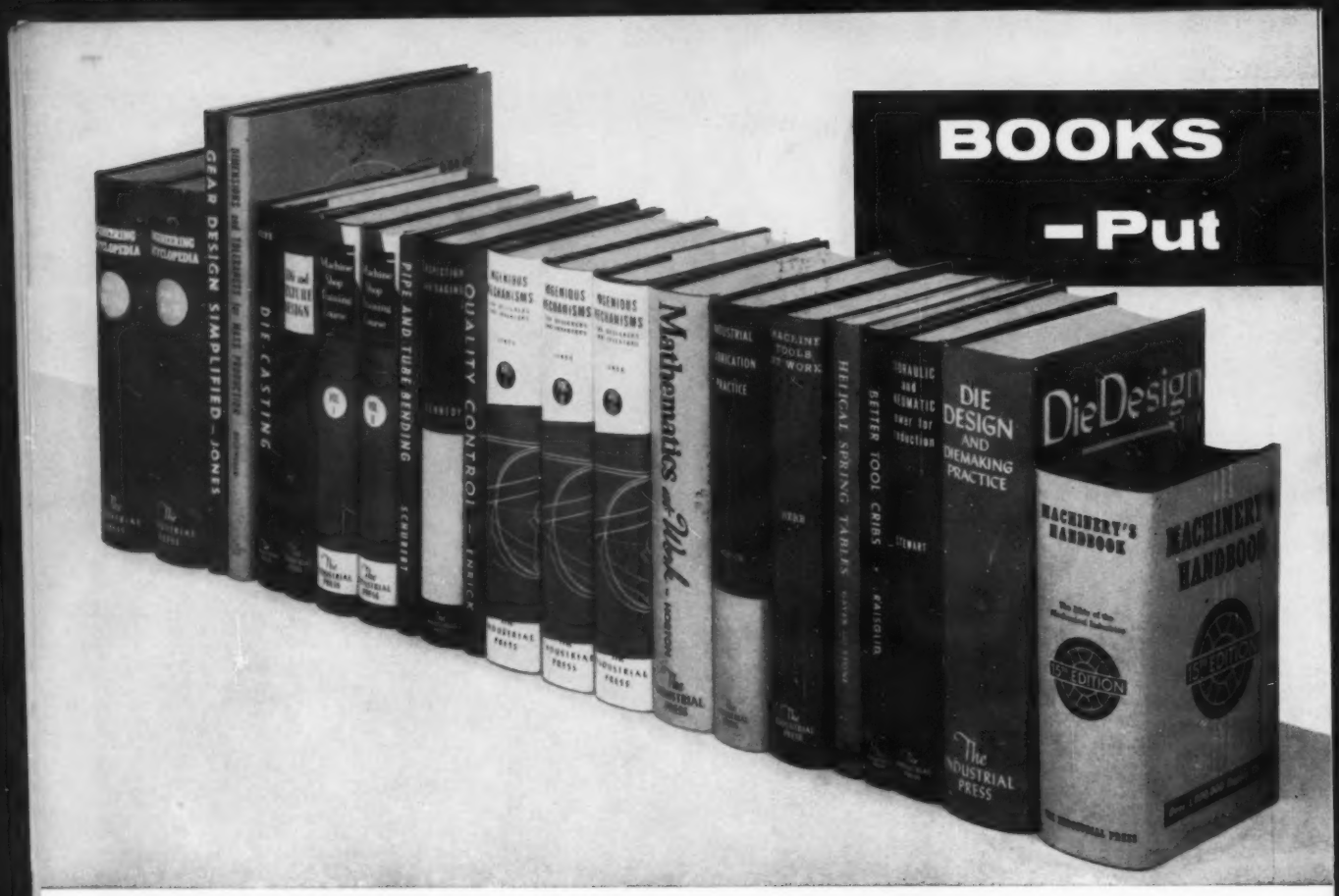
SPRINGFIELD 7, MASSACHUSETTS

For more data, circle page number of this ad on inquiry card



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Based on plant-tested scientific principles, this edition uses simple tabulated data with direct instructions which anyone can apply. Concrete examples show how statistical quality control is used under different manufacturing conditions. Shows how manufacturers can improve the average quality of their products—and save money at the same time. 38 Charts and Tables. 181 Pages.

$4.50 By mail, Canada or overseas, $5.50.

The Industrial Press, 93 Worth St., New York 13, N. Y.

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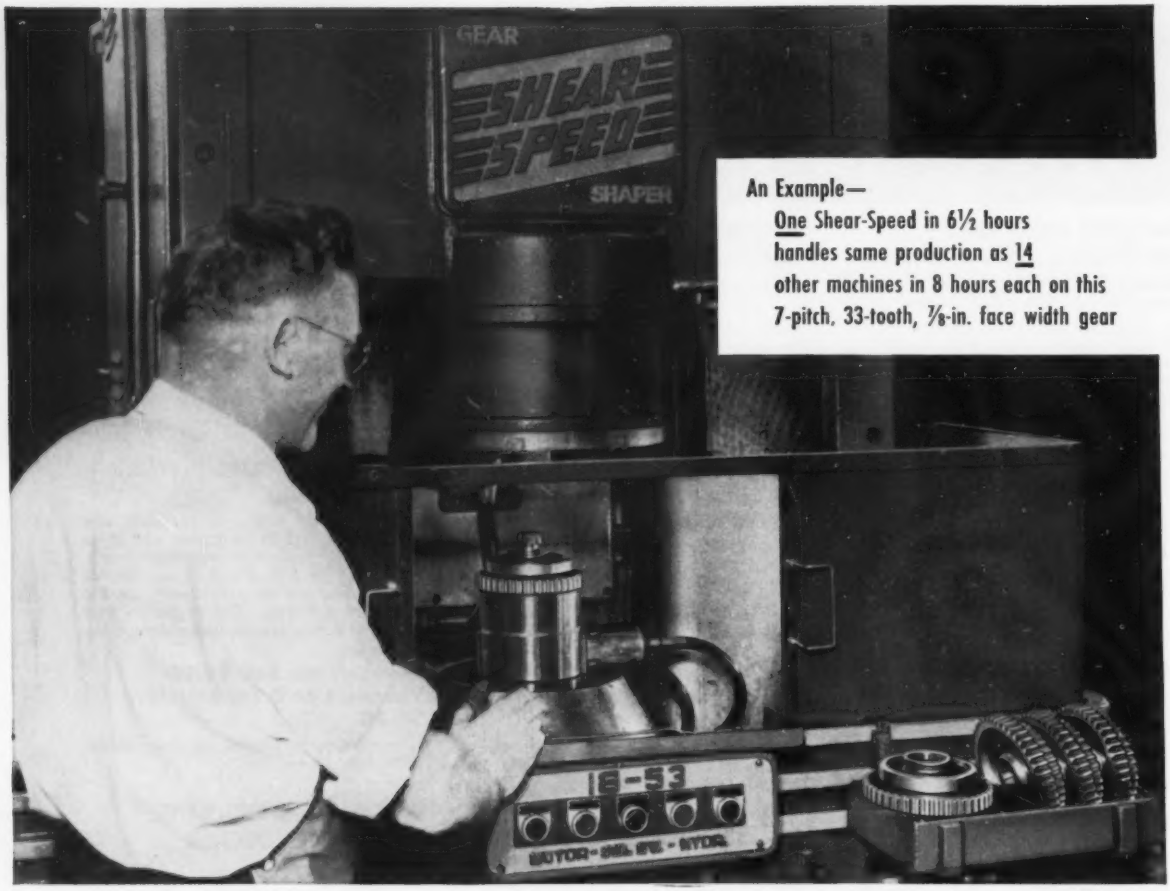
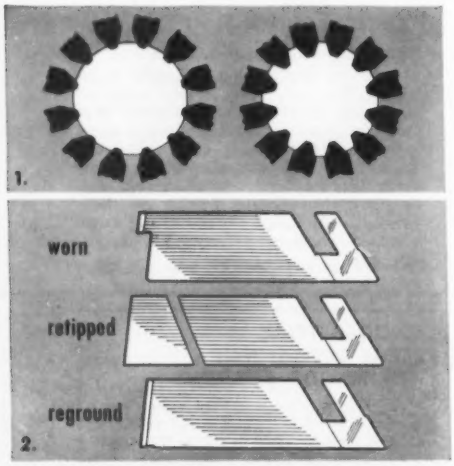


Boost your productivity with *SHEAR-SPEED*® gear shapers



1. In the Shear-Speed process all teeth are cut simultaneously. Gear-size capacity from 1 to 20 inches.

2. Shear-Speed cutting blades can now be retipped economically by new Michigan cost-cutting service.

If you're interested in higher productivity in your gear and toothed parts departments, the one sure process is Shear-Speed gear shaping—the one process that cuts all teeth of external or internal gears at one time in just seconds. Shear-Speed gear shaping is now the basic production method in a broad range of manufacturing fields—on gears, splines, sprockets, cams, ratchets, clutches, etc. New improvements now make Shear-Speed bigger cost savers than ever—with lower tool costs; easier automation. Other features: top accuracy, low maintenance and easy operation. Let a Michigan representative plot your toothed-part production against Shear-Speed time cycles. You'll be surprised at the productivity . . . and savings.

MICHIGAN TOOL Company

from blank to finished gear

7171 E. McNICHOLS RD., DETROIT 12, MICH., U.S.A.
IN CANADA: COLONIAL TOOL CO. LTD.

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4 OF THE MANY STYLES OF THE ONE-PIECE SEAMLESS DOOR KNOBS FABRICATED FROM RUGGED REVERE BRASS STRIP.

REVERE BRASS STRIP Stands the Gaff!

The one-piece door knobs shown are drawn from a single blank of Revere Brass Strip, presenting an attractively smooth, unbroken surface without the need for seams or welds.

Because they are made by a unique procedure the manufacturer tells us that the brass must stand up under mighty rugged going, and that to produce the quality knobs they do, at an economical production level, the brass they use must have:

1. *Uniformity of gauge.*
2. *Absence of any sign of fracture or crimping when drawn.*
3. *Consistently correct grain structure to insure a smooth, flaw-free surface on the finished knobs.*

The manufacturer also tells us that Revere Brass Strip has been filling that bill, with utmost satisfaction, for some time.

Revere Brass Strip may be able to help *you* make a better product at less cost. You'll never know until you talk it over with one of our TA's (Technical Advisor). There's no obligation, of course. And such a discussion could save you a substantial sum of money. Such has been the case many, many times.

COPPER ★ BRASS ★ 18 01 ★ REVERE ★ ALUMINUM

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

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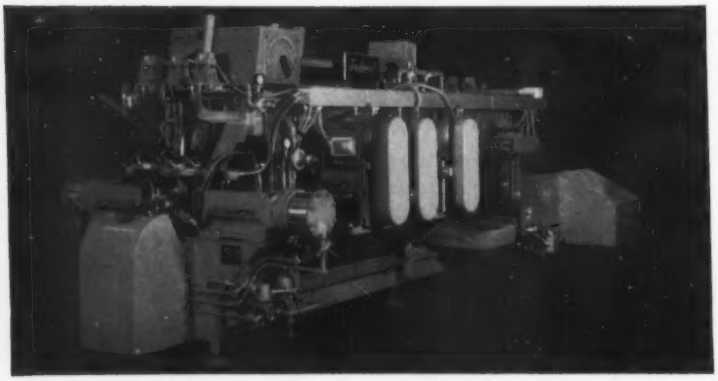
one-source production lines spark interest of volume producers...

The prospect of ordering an entire production line, ready made to produce a part to specification, has arrested the interest of many of the nation's top production engineers.

One source responsibility assuring better service; a line 100% harmonic, all stations engineered to work in perfect synchronization; integrated and automated handling of work in process; utilization of common drives and bases, reducing operating costs and floor area, are some of the advantages of the packaged line that has production people talking.

Federal/Warco pioneered the packaged line and have already produced automated lines combining such operations as blanking, forming, drawing, welding, machining, drilling, assembling on a common base.

For additional information contact the Federal/Warco representative nearest you or write direct.



This Federal Packaged Production line welds, spot faces, reams, de-burrs, sets six bolts and welds them in place . . . ejecting finished pedal brackets at a rate of 775 pieces per hour.

Federal / Warco
PACKAGED
PRODUCTION LINES

THE FEDERAL MACHINE AND WELDER COMPANY - WARREN, OHIO

422 AFFILIATED WITH BERKELEY-DAVIS, INC., DANVILLE, ILLINOIS, MANUFACTURERS OF AUTOMATIC ARC WELDING EQUIPMENT.

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precision NH *bearings*

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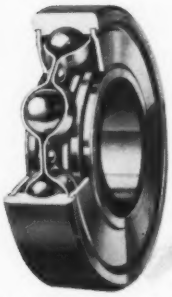
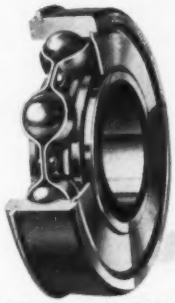
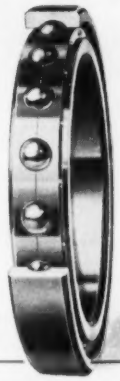


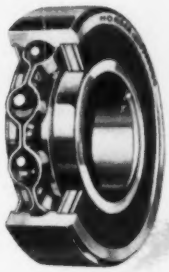
DOUBLE SHIELDED BALL BEARING



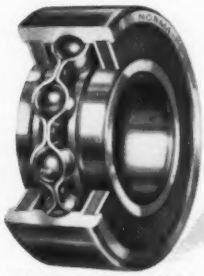
SHOULDER RING SINGLE SHIELDED BALL BEARING



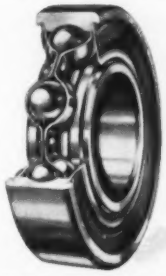
EXTRA LIGHT BALL BEARING



FELT SEALED AND SHIELDED BALL BEARING

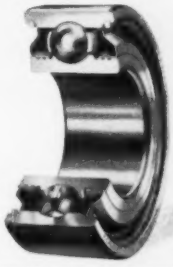


DOUBLE FELT SEALED BALL BEARING

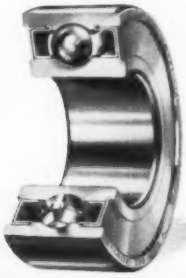


DOUBLE RUBBER SEALED BALL BEARING

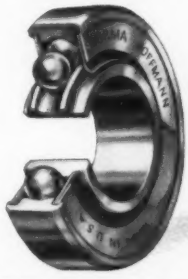
DOUBLE METAL SEALED BALL BEARING



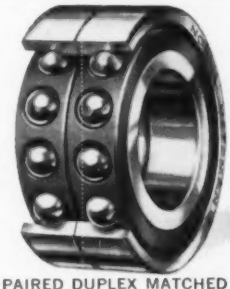
"CARTRIDGE" BALL BEARING WITH REMOVABLE SEALS



"CARTRIDGE" BALL BEARING WITH FLINGER SEALS



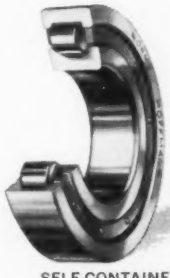
AIRCRAFT CONTROL FULL TYPE RUBBER SEALED BALL BEARING



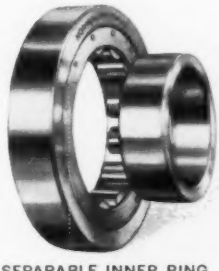
PAIRED DUPLEX MATCHED SUPER-PRECISION BALL BEARINGS

BALL THRUST BEARING

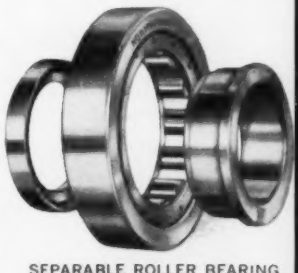
SEPARABLE OUTER RING ROLLER BEARING



SELF-CONTAINED ROLLER BEARING



SEPARABLE INNER RING ROLLER BEARING



SEPARABLE ROLLER BEARING WITH EXTRA THRUST RING

NH

NORMA-HOFFMANN BEARINGS CORPORATION / STAMFORD, CONNECTICUT

founded in 1911

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Just as a matter of machining economy—
Why don't you investigate

CARMET INDEXABLE INSERTS
AND TOOLHOLDERS

Cost to regrind single point tool	*50¢ to 1.50*
Cost to regrind Carmet Indexable Inserts	*NOTHING*
Cost of 800 brazed single point tools at approx. $3.50	*$2,800.00*
Cost of 100 square Carmet Indexable Inserts with 800 cutting edges, approx.	*$100.00*

Plus **savings in higher production, longer tool life, tool storage, tool inventory, less tool-change downtime**

Over 9 styles and 109 sizes in Carmet cadmium plated tool holders. 6 carbide grades for machining almost all material from wood and plastics to high alloy steels.

WSW 7324

Write for new Catalog C-16

CARMET CEMENTED CARBIDES FOR INDUSTRY

This 32-page first edition contains prices and complete specifications on Carmet's full line of cemented carbide tipped tools, blanks and holders. Speed and feed charts, grade comparisons and ordering information included.

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See your Carmet Distributor now or write
Carmet Division, Allegheny Ludlum, Detroit 20, Michigan

CARMET

CEMENTED CARBIDE DIVISION OF
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AL

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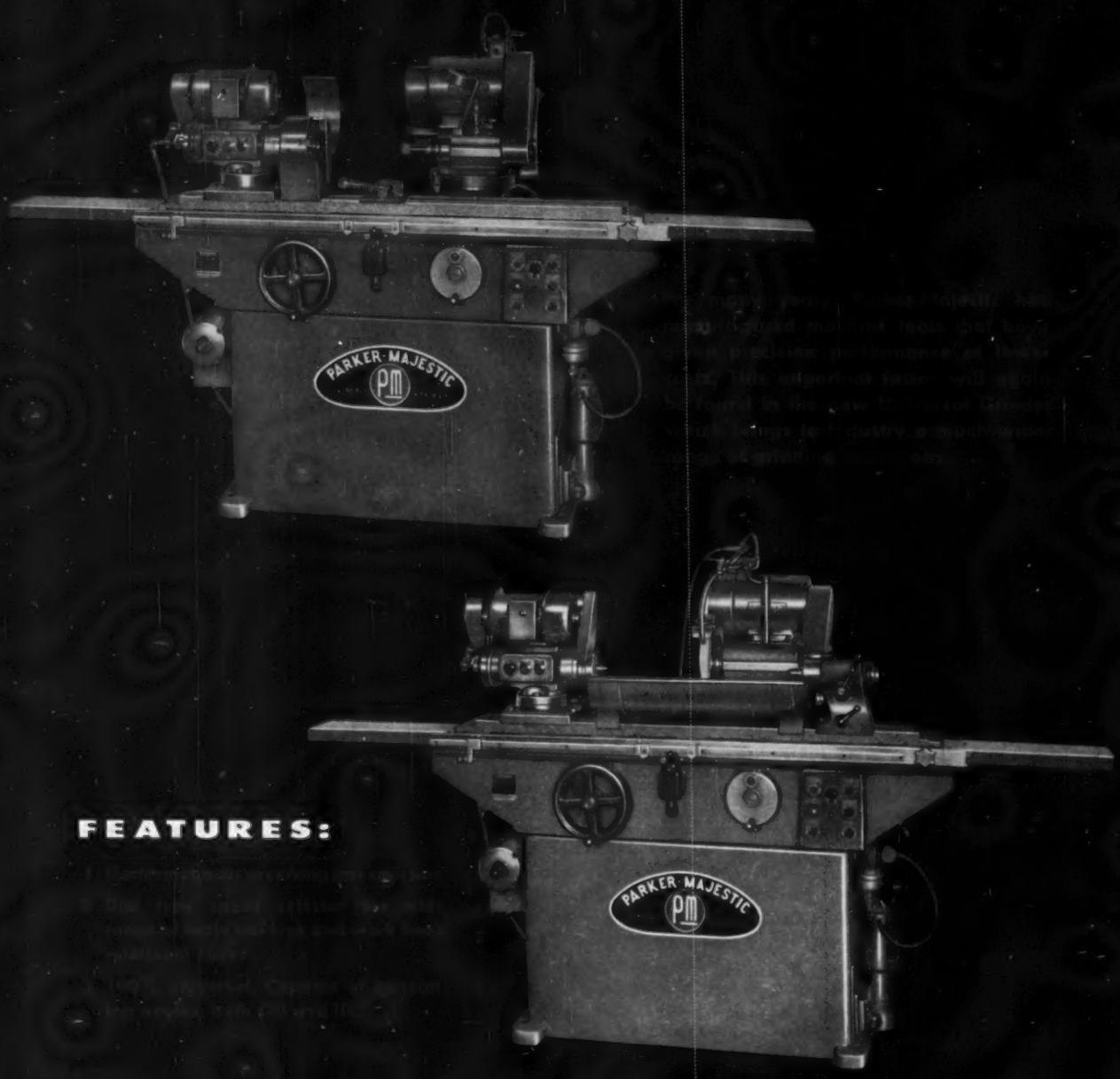
No. 2 UNIVERSAL GRINDER



FEATURES:

PARKER • MAJESTIC PM PRECISION MACHINES

Product Directory

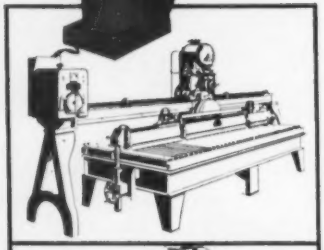
To find headings easily, look for capital letters at top of each page to denote location.

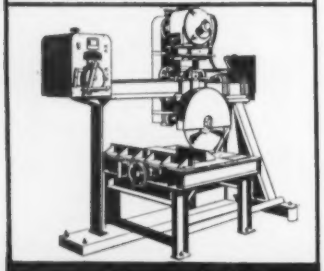
ABRASIVE CLOTH, Paper and Belt
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Gardner Machine Co., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Norton Co., 1 Bond St., Worcester 6, Mass.

ABRASIVES, Disc
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

ABRASIVES, Polishing, Tumbling, Etc.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.

HIGH-SPEED SAW WITH CLAMP TABLE MAKES IRREGULAR SHAPE CUTS





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LOW INVESTMENT SAW CUTS METAL FAST & CLEAN

Whether you're making straight cuts, odd angle cuts or irregular shapes such as turbine impeller blades, you'll find the Ty-Sa-Man 144 BD combination of speed and amazing accuracy will save you money. Table has positive air-driven clamps to hold material in any position. Other Ty-Sa-Man cut-off models from 10" to 58" cuts . . . long-cut saws for 4' to 60' cuts, with or without cross movement, for friction or abrasive sawing.

Ty-Sa-Man
SINCE 1885

TY-SA-MAN MACHINE CO., INC.
1093 White Ave., Knoxville, Tenn.

ACCUMULATORS, Hydraulic
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

AIR GAGES, Dimensional—See Gages Air Comparator

AIR GUNS
Chicago Pneumatic Tool Co., New York 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic—Drills, Portable, Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Mueller Brass Co., Port Huron, Mich.

ALLOYS, Non-ferrous—See Brass, Copper, Zinc and Stellite

ALUMINUM and Aluminum Products
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

ANGLE PLATES—See Set-Up Equipment

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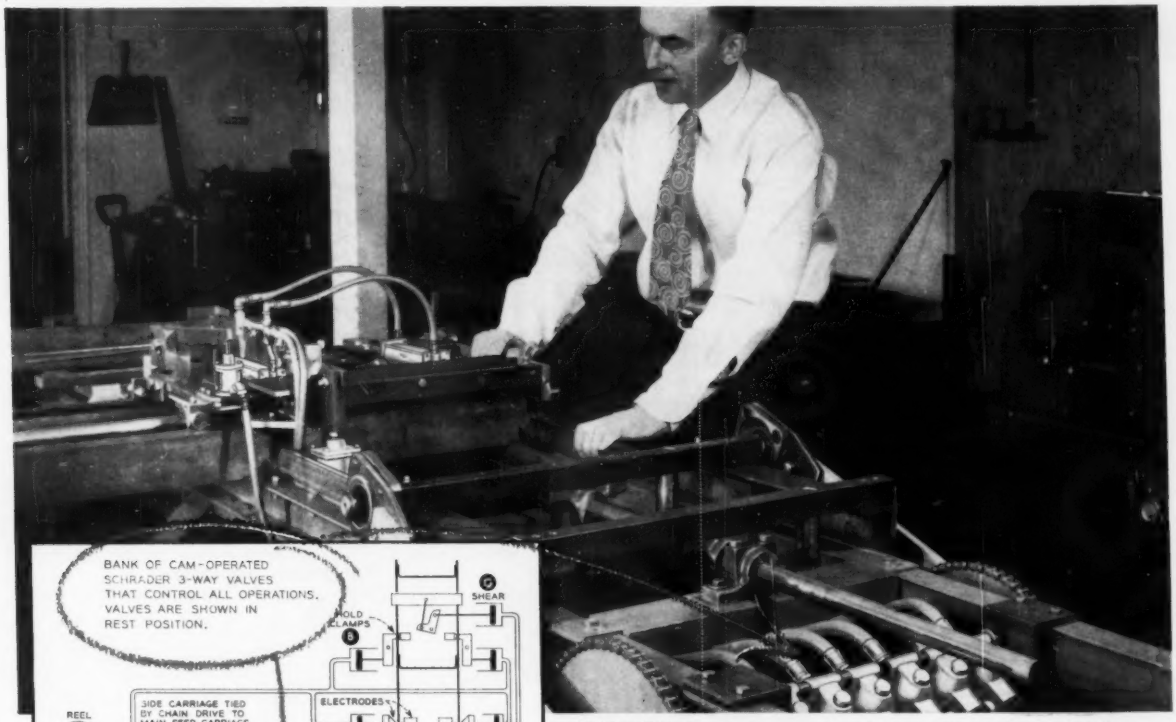
YOU, TOO, CAN AUTOMATE IT YOURSELF ...WITH SCHRADER AIR PRODUCTS

Very often you can automate manufacturing operations simply by applying Schrader air controls to existing plant facilities.

Here's a man with ideas who automated a complex job—increased production, reduced unit costs, safely and easily—without making a large capital investment. He did it with a planned Schrader air control system. Chances are excellent that you can do the same thing—with Schrader air products. Air can do an almost limitless range of work: automatic drilling, reaming, clamping and holding, shearing, forming, staking, grouping and interlocking assembly operations for quicker parts handling and assembly.



PROBLEM: Feed heavy wires into machine, shear off pieces, shape them, weld pieces together and eject as finished wire webbing. Fast. Economically. Automatically.

SOLUTION: Air Controls selected from Schrader's complete line. Neat bank of valves—actuated by cams on master cam shaft—operate synchronized system. Clamps A feed wires to holding Clamps B as carriage moves back and forth. Counter-actuated valve F operates cut-off shear G after desired number of cycles. Wire C, fed from carriage D, is sheared, formed by dies E, welded to the other two wires.

RESULT: One man performs *double* the output of three men at a fraction of the cost of a new machine.

Design it yourself! Schrader Air Control components—the most reliable self-contained power units—can help you adapt quickly to your manufacturing needs.

Schrader®
a division of SCOVILL

QUALITY AIR CONTROL PRODUCTS

A. SCHRADER'S SON • *Division of Scovill Mfg. Co., Inc.*
454 Vanderbilt Ave., Brooklyn 38, N. Y.

How do I start? How did others get started? Send me informative literature and information about Schrader's Automate-It-Yourself Air Products.

Name _____ Title _____

Company _____

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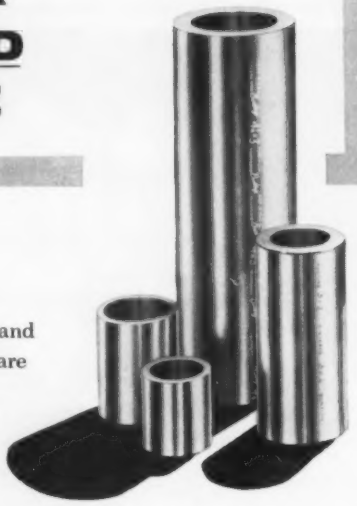
. . . now your distributor can supply **both**

Bunting®

CAST OR SINTERED BRONZE

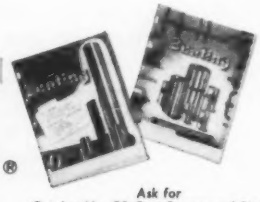


Fast pick-up...

Stock sizes of Bunting Cast Bronze and Sintered Bronze Bearings and Bars are available everywhere in America. Every one is a precision product of scientifically exact manufacturing methods, meeting on every point the highest standards of quality as defined by modern mechanical engineering and metallurgy.

FIRST AWARD
For Advertising Excellence
Distributors Associations
1952 1956 1958

Your Bunting distributor is listed in the classified section of your telephone directory usually under Bars — Bronze, and Bearings — Bronze. Two Bunting factories and eleven Bunting Branch Warehouses expedite distribution in all areas. Ask your local Bunting distributor or write for catalogs.



Ask for
Catalog No. 58-Cast Bronze and Sintered Bronze Bearings and Bars
Catalog No. 258-Electric Motor Bearings and Cast Bronze Bars

Bunting®

BUSHINGS, BEARINGS, BARS, AND SPECIAL PARTS OF CAST BRONZE AND POWDERED METAL

THE BUNTING BRASS AND BRONZE COMPANY • TOLEDO 1, OHIO • BRANCHES IN PRINCIPAL CITIES

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Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Supreme Products, Inc., 2222 S. Calumet Ave., Chicago 16, Ill.

ARC WELDERS—See Welding Equipment, Arc

ASSEMBLING MACHINES
Detroit Power Screwdriver Co., 2799 W. Fort St., Detroit 16, Mich.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Sheffield Corp., Box 893, Dayton 1, Ohio

AUTOMATIC SCREW MACHINES—See Screw Machines, Single and Multiple-Spindle Automatic

AUTOMATION EQUIPMENT
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

BABBITT
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BACTERICIDES
Lilly, Eli and Co., Indianapolis 6, Ind.

BALANCING EQUIPMENT
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALLS
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Hoover Ball & Bearing Co., Ann Arbor, Mich.

BAR MACHINES—See Screw Machines, Single and Multiple-Spindle, Automatic

BAR STOCK, Non-ferrous
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Mueller Brass Co., Port Huron, Mich.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BAR STOCK AND SHAFTING, Steel
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

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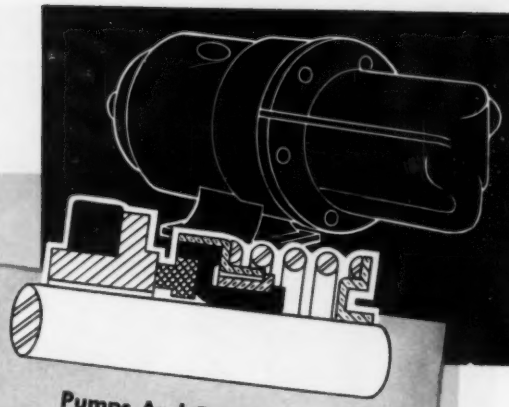
Machine Tools And Power Transmission Equipment

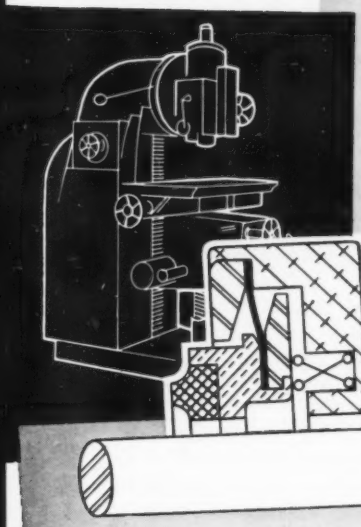
STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.



Pumps And Compressors

ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

STYLE RFO — A specially designed Roto-flex seal, for installation outside the stuffing box. Stock sizes for shafts .250 through 4.000.



Heavy Machine Tools

STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.

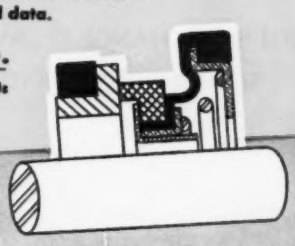
A Complete Line
GITS SHAFT SEALS
For Every Application

These modern, mechanical, face-type seals are carried in stock — to save you time and money. Write for detailed data.

GITS BROS. MFG. CO.

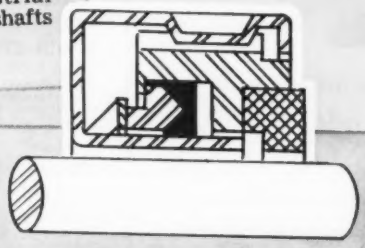
1858 South Kilbourn Avenue • Chicago 23, Illinois

Specialists In Lubricating Devices And Shaft Seals For Almost Half-A-Century



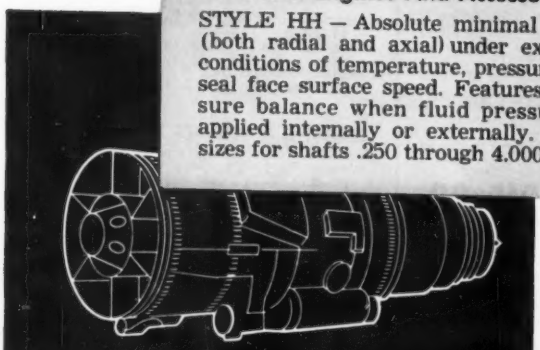
Household Appliances

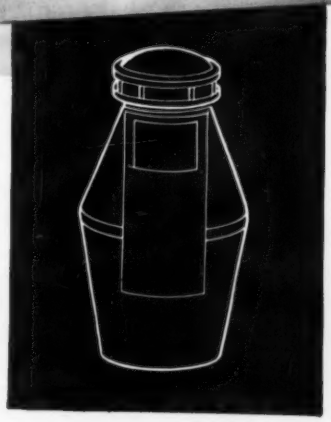
STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.



Aircraft Engines And Accessories

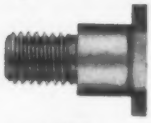
STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.





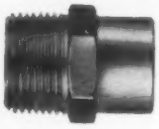
you change Only the Rolls in a Reed Thread Rolling Attachment

WHEN YOU CHANGE FROM STRAIGHT THREADING



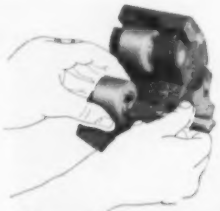
9/16—12 UNC

TO TAPER THREADING



3/4—14 NPTF

no other equipment is needed and the change is quickly made by simply removing the roll spindles and inserting new rolls.



Each Reed Standard Series B Attachment rolls a complete range of thread sizes—both straight and taper. Adjustable roll pin support arms provide a simple adjustment for this full capacity range.

Write for your copy of Thread Rolling Attachment Bulletin B-2 for helpful information on Thread and Form Rolling

REED RTD TRA-168

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

WORCESTER 1, MASSACHUSETTS, U. S. A.

Sales Offices In: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

BEARINGS, Ball
Ball & Roller Bearing Co., Danbury, Conn.
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Japan Bearing Export Co., Ltd., Tokyo, Japan
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio

BEARINGS, Needle
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio

BEARINGS, Oilless
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio

BELT SANDERS—See Grinding Machines, Abrasive Belt

BENCH CENTERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BENDERS, Bar, Tube, Channel, etc.
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BENDERS, Plate, Etc.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BENDING MACHINES, Hydraulic
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engineering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Hydraulic Press Mfg. Co., Mount Gilead Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

For more data, circle page number of this ad on inquiry card

"Far Superior to its Competition"...

. . . states Mr. Creighton Blanchard, toolroom superintendent at New Hampshire Ball Bearings, Inc., Peterborough, New Hampshire

THE NEW, IMPROVED THOMPSON TYPE D HAND FEED

SURFACE GRINDER

is winning enthusiastic approval wherever precision work is required

Here's what Mr. Blanchard has to say about the new Type D machine:

"We have three grinders in our toolroom—a Thompson and two competing machines. In our general toolroom grinding, especially on carbide and hard metals, we find the Thompson Type D so superior that we have recently purchased another Thompson just like it. All our precision work goes on the Thompson."

Compare these features

- Steel roller anti-friction slides eliminate ball creep and increase rigidity.
- 14" standard vertical capacity under 7" wheel at no extra cost with no loss in vertical capacity when using wet attachment.
- Solid support through entire length of bearing quill assures extra fine finish.
- 5 inch table movement per turn of handwheel improves quality of finish and speeds up operations.
- No backlash, anti-friction ball nuts and screws on cross feed prevent wheel from creeping away from work in shoulder grinding.
- Swing-out stop for table dog contact permits quick movement to wheel dresser.
- Immediate delivery available.

Send for descriptive literature on the new Thompson Type D Grinder.

THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO

"Keep Thompson in mind for that daily grind"

Thompson SURFACE GRINDERS

For more data, circle page number of this ad on inquiry card

NEW in our line is a complete range of heat treated alloy steel Dowel Pins... ⅛" to 1". They have a surface hardness C60-64, with micro-finish 8 RMS maximum. Standard pins are ground .0002" (over-size pins ground .001").
ONE BIG FAMILY...
WITH
Blue Devil DOWEL PINS
BLUE DEVIL DOWEL PINS and Socket Screw Products feature the same high standards of quality, design and strength that have made the Blue Devil line a "buy-word" of reliability for more than a quarter-century. See your distributor today... or real soon. You'll be glad you did!
MEMBER ASMMA
SOLD ONLY THROUGH AUTHORIZED INDUSTRIAL DISTRIBUTORS
SAFETY SOCKET SCREW CO.
6513 North Avondale Avenue • Chicago 31, Illinois
Warehouses at:
Los Angeles • San Francisco • Detroit • New Haven • New York City

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BENDING ROLLS
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland, Ohio
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BLAST CLEANING EQUIPMENT
Pangborn Corp., Hagerstown, Md.

BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

BLUING LAYOUT
Dykem Co., 2307 N. 11th St., St. Louis 6, Mo.

BOLT and NUT MACHINES
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

BOLTS, NUTS AND SCREWS
Allen Mfg. Co., Bloomfield, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Northwestern Tools, Inc., 115 Hollier Ave., Dayton 3, Ohio.
Orban Kurt Co., Inc., 42 Exchange Place Jersey City 2, N. J.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOOKS, Technical
Industrial Press, 93 Worth St., New York 13, N. Y.

BORING BARS
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Kennametal Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 327, Roosevelt Park Annex, Detroit 32, Mich.
Universal Engineering Co., Frankenmuth 2, Mich.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

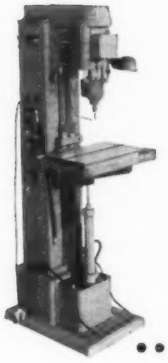
BORING HEADS
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Bridgeport Machines, Inc., 500 Lindley St., Bridgeport 6, Conn.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
Universal Engineering Co., Frankenmuth 2, Mich.

BORING MACHINES
Baker Bros. Inc., 1000 Post Ave., Toledo 10, Ohio
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro. Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

(Continued on page 250)

For more data, circle page number of this ad on inquiry card

this plate paid for itself in 11 hours...



...and is still tapping 4400 holes per hour one year later!

The only tooling needed was the 15-position dial plate to hold the parts. The plate was bolted simply to a standard Snow Dial Index fixture on a standard Snow universal tapping machine.

We made the plate for our customer for $165.00. It arrived in his plant 6 days after he delivered a box of blank parts to us. With the plate went a tag showing Snow machine settings, and estimated hourly production based on the *test run already made* in our own shop. Time required for customer to set up the new dial plate was ten minutes!

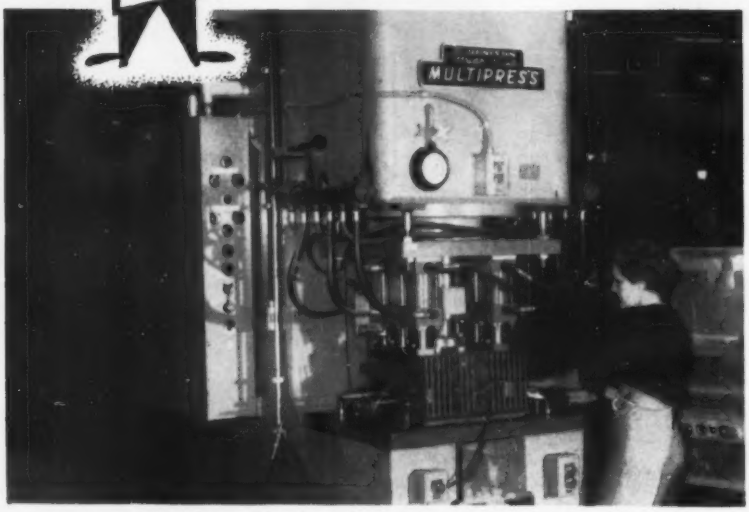
Standard universal Snow machines for drilling, tapping, or threading are available in vertical, horizontal or angular models. Their modest price will amaze you. They reduce changeover time, and cut tooling costs to a ridiculous minimum. 28 different types of standard air-operated fixtures are available from stock. On your next job, let us show you what the Snow method can do. Submit samples and prints.

Snow Manufacturing Company, 435 Eastern Avenue, Bellwood, Illinois (suburb of Chicago). Dept. M.

SNOW *master fixtures save dollars and days in tooling costs.*

For more data, circle page number of this ad on inquiry card

Here's how they do
precision jobs better, at lower cost
...with MULTIPRESS!



100-TON MULTIPRESS *precision-punches up to 450 holes at a time for Motorola.*

MOTOROLA punches TV chassis faster, cuts scrap loss with DENISON Multipress

THESE Motorola radio-TV plated-circuit plastic chassis bases are precision-punched faster . . . more accurately . . . at less cost with Denison hydraulic Multipress.

Here's why: with one quick ram-stroke, a 100-ton Multipress punches up to 450 holes at a time in each base. Holes are clean and smooth... affording the necessary uniform plating surface inside each hole. There's *no bulging . . . no cracking* around or between holes because Multipress delivers controlled hydraulic pressure.

Plus benefits with Multipress—longer die life . . . almost no punch breakage . . . *far less scrap loss* . . . handles 15 different dies for quick changeover to other full-production jobs.

Endless jobs throughout the electronic and other industries can be done faster . . . for less cost with Denison hydraulic Multipress—from 1 to 100 tons. Ask your Denison Production Specialist to show you how.

BEFORE AND AFTER . . . *plated-circuit chassis are punched faster . . . with less scrap . . . to precision limits with Denison hydraulic Multipress.*

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1152 Dublin Road • Columbus 16, Ohio

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

Denison, Denison HydrOILics, and Multipress are registered trademarks of Denison Eng. Div., ABSCO

DENISON HydrOILics

Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Machine Co., Springfield, Vt.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Moline Tool Co., Moline, Ill
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893 Dayton 1, Ohio
Wales-Strippit Co., Akron, N. Y.

BORING MILLS, Horizontal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain, Conn.

BORING MILLS, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp, 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
New Britain Mch. Co., New Britain, Conn.

BORING TOOLS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Vascoloy-Ramet Corp., Waukegan, Ill.

BRAKES, Press and Bending

Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Ferracute Machine Co., Bridgeport, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BRASS

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

BROACHES

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

For more data, circle page number of this ad on inquiry card

Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

BROACHING MACHINE, Internal
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINE, Surface
Cincinnati Milling & Grinding Mchs., Inc., Cincinnati, Ohio.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BRONZE
American Brass Co., Waterbury 20, Conn.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Tampico, Wire Wheel, Etc.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

BULLDOZERS, Metalforming
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.

BURNISHING MACHINES
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

BURRING MACHINES—See Deburring Machines

BURRS—See Files and Burrs, Rotary

BUSHINGS, Drill Jig
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Corbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Hardened Steel
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Non-ferrous and Powdered Metal
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

CALIPERS, Spring, Firm-Joint, Transfer, Hermaphrodite, etc.—See Layout and Drafting Tools, Machinists' Small Tools

CALIPER, Vernier
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

CAM CUTTING MACHINES
Cincinnati Milling & Grinding Mchs., Inc., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York, 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

CAM MILLING AND GRINDING MACHINES
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngtown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

CASTINGS, Die
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Pittsburgh Brass Mfg. Co., 3199 Penn Ave., Pittsburgh 1, Penna.
Vascoloy-Ramet Corp., Waukegan, Ill.

CASTINGS—Gray Iron, Malleable
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CASTINGS, Steel, Stainless, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.

CEMENT, Abrasive Disc
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

CENTER-DRILLING MACHINES
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES—See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio.

(Continued on page 252)

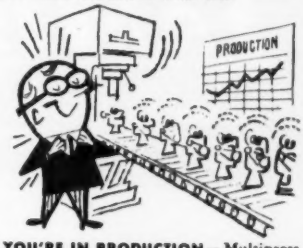
Solve your pressing problems fast with...

DENISON
Super Market
Multipress service!

1. GOT A PROBLEM? Which pressing job has you stumped – how to make it . . . do it faster . . . turn it out for less? Bring in your job . . . talk it over with a Denison Multipress Specialist.

2. OUR "IDEA FILE" IS AMAZING – Details on thousands of pressing applications – assembly, broaching, crimping, staking operations – production-proved on Multipress. Any job from Aircraft staking to Zipper making.

3. WE'LL TEST-RUN YOUR JOB – In our production lab. See how Multipress actually does the job . . . how fast and at what cost.



4. YOU'RE IN PRODUCTION – Multipress can mean faster, higher quality output at less cost. There's a complete Multipress line – from 1 to 75 tons. What's *your* pressing problem? Let's tackle it now.

in **DETROIT**
900 West Maple Road
Troy, Michigan
Phone: JUniper 8-2800
and in – CHICAGO • NEWARK • CLEVELAND
HOUSTON • ATLANTA • LOS ANGELES
DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1152 Dublin Road • Columbus 16, Ohio

Houston Grinding & Mfg. Co., Inc., Houston 8, Texas.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Multiple-Spindle Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKING MACHINES, Single-Spindle Automatic

Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford, 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Collet

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cushman Chuck Co., 800 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Combination Universal-Independent

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Compensating

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm

Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Drill, Key Type

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Drill, Keyless

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Full Floating

Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.

Exclusive Feature!

YOU NEVER LOSE TIME WITH...

LAMINUM®

—the solid Shim that p-e-e-l-s for adjustment!

Laminated Shims of Laminum have these exclusive features to offer: they're custom-made .any size, any shape...to your own exacting requirements, including rigid Aircraft specifications . with all laminations completely surface-bonded to look and act like solid metal...*yet may be p-e-e-l-e-d to required thickness quickly and easily... for a "thousandth" fit right at the job.* No need for time-consuming, costly extra operations: no machining—no grinding—no stacking—no counting—no miking—and no grit between layers, ever!

THE LAMINATED SHIM CO., INC.

Shim Headquarters since 1913
3912 Union St., Glenbrook, Conn.

Please send, without obligation, detailed Engineering Data File on LAMINUM—the solid Shim that p-e-e-l-s for adjustment.

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE _____ STATE _____

Brass with laminations of .002" or .003"

Mild Steel with laminations of .002" or .003"

Stainless Steel with laminations of .002" or .003"

Aluminum with laminations of .003" only

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Supreme Products, Inc., 2222 S. Calumet Ave., Chicago 16, Ill.

CHUCKS, Independent
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Walker, O. S. Inc., Worcester, Mass.

CHUCKS, Power Operated
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety
Jacobs Mfg. Co., West Hartford 10, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

CHUCKS, Universal Three-Jaw
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., Madison 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Wrenchless
Gisholt Mch. Co., Madison 10, Wis.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment

CLEANERS, Metal
Oakite Products, Inc., 26 Rector St., New York, N. Y.

CLUTCHES
Cleveland Punch & Shear Works, Co., 3817 St. Clair Ave., Cleveland 14, Ohio.
Conway Clutch Co., 2747 Colerain Ave., Cincinnati 25, Ohio.
Dynamatic Div. Eaton Mfg. Co., Kenosha, Wis.
Minster Mch. Co., Minster, Ohio.

COLD HEADING
National Machinery Co., Tiffin, Ohio.

COLLETS—See Chucks, Collet

COLLOIDAL GRAPHITE
Acheson Colloids Co., 2150 Washington Ave., Port Huron, Mich.

COMBINATION SQUARES—See Machinists' Small Tools

COMPARATORS, Dial, Electronic and Air
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 883, Dayton 1, Ohio.
Starrett, L. S., Co., Athol, Mass.

COMPARATORS, Optical
Bausch & Lomb Optical Co., Rochester, N. Y.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York 13, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleanings—See Cleaners, Metal

COMPOUNDS, Cuttings, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

Exclusive Feature!

YOU ALWAYS GET THE LOWEST POSSIBLE PRICE ON

STAMPINGS

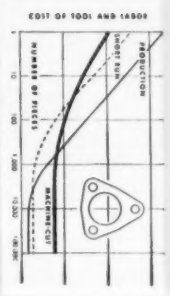
from the Laminated Shim Company

Here's why...we've been concentrating on the manufacture of both Laminated Shims *and* Stampings since 1913. Consequently we have developed our own special equipment and tooling, plus many special skills and techniques of our own—most of them unknown to the average stampings house. The result: always the lowest possible cost, based on your own quality-quantity requirements. Cash in on Laminated Shim Company's better Stampings Service...it's as easy as 1-2-3, as outlined below.

1. FOR A FEW PIECES
at Experimental or Pilot Stage
—we use our MACHINE CUT METHOD. No dies needed. Our special equipment, plus our unique techniques, are applied to produce small quantities at very low cost.

2. FOR SHORT RUNS
—we use our SHORT RUN METHOD. "Temporary" low-cost tooling, simple dies, plus special presses go to work to produce something more than "just a few." Quality is high—costs stay low.

3. FOR PRODUCTION RUNS
—we use our PRODUCTION RUN METHOD. Here is where our production toolings apply to great advantage, and when dies are needed, charges are moderate. The chart tells the story...top quality stampings at lowest possible unit cost.



ANY ONE OF THESE 3 METHODS WILL PRODUCE AIRCRAFT-QUALITY STAMPINGS TO YOUR OWN RIGID STANDARDS

THE LAMINATED SHIM CO., INC.
Stampings Headquarters since 1913
3912 Union St., Glenbrook, Conn.

Please send, without obligation, your 12-page Stampings Booklet that shows how to save on stampings.

NAME _____ TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____

What is done is DONE... on the GOSS & DeLEEUW

AUTOMATIC CHUCKING MACHINE

There are no half-finished pieces lying around at the end of the day when you put your work on this outstanding machine.

The "1-2-3" feature—available only on the Goss & De Leeuw Automatic Chucker —provides the means of finish machining three ends of a part without changing set-up.

Note some of the typical parts machined. Ask for illustrated literature giving further details and send samples of your work for a cost estimate on handling it on the Goss & De Leeuw.

GOSS & DeLEEUW QUALITY PRODUCT-QUANTITY

GOSS & DeLEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

COMPRESSORS, Air
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

CONTOUR FOLLOWER—See Tracing Attachments

CONTRACT WORK
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Van Keuren Co., Watertown, Mass.

CONTROLLERS
Allen-Bradley Co., 1331 S. 1st St., Milwaukee, Wis.

CONVEYORS FOR DUST, CHIPS, ETC.
Barnes, W. F. & John Co., Rockford, Ill.

COPPER
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

COUNTERBORES AND COUNTERSINKS
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

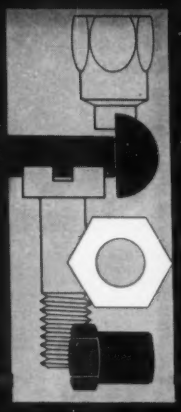
COUNTER
Starrett, The L. S., Co., Athol, Mass.

COUPLINGS
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Mueller Brass Co., Port Huron, Mich.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

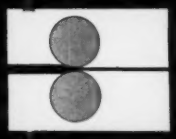
CUTTERS, Keyseating
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
DoALL Co., Des Plaines, Ill.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.

For more data, circle page number of this ad on inquiry card



COLD HEADING MACHINERY

Cold Headers • Parts Formers • Nut Formers • Slotters • Threaders • Pointers • Trimmers and other Cold and Hot Forming Equipment

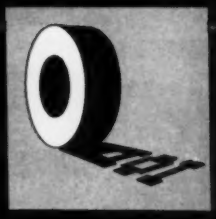


ROLLING MILL MACHINERY

Two-High and Four-High Mills • Special Mills • Sendzimir Mills • Rod Mills • Slitters • Coilers • Winders • Straighteners • Payoffs • Edgers • Coil Boxes • And Other Mill Equipment

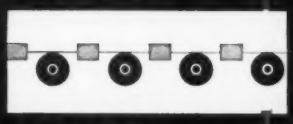
WATERBURY FARREL

MACHINERY BUILDERS



WIRE MILL EQUIPMENT

Continuous Tandem And Upright Cone Wire Drawing Machines • Bull Blocks • Wire Flattening Mills •



Swagers • Roll Pointing Machines • Spoolers • And Other Wire Equipment

POWER PRESSES

Cam and Crank Eyelet Machines • Horizontal Redraw Presses • Multiple Plunger Pillar Presses • High Speed Blanking Presses • Collapsible Tube Equipment • Ammunition Machinery, etc.

THE WATERBURY FARREL FOUNDRY & MACHINE CO.

DIVISION OF TEXTRON INC.

Waterbury, Connecticut • U.S.A.

Sales Offices: Chicago • Cleveland • Los Angeles • Millburn, N. J.

WF-51R

CUTTERS, Milling

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio.
National Twist Drill Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Tomkins-Johnson Co., Jackson, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoALL Co., Des Plaines, Ill.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 3, Ill.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES, Lathe Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Windsor, Vt.
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
DoALL Co., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

CUTTING TOOLS—See Tool Material

CYLINDERS, Air

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers, Inc., Detroit 32, Mich.

DEBURRING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Lufkin Rule Co., Saginaw, Mich.

DIE CASTINGS—See Casting, Die

DIE CASTING MACHINES

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Minster Machine Co., Minster, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

DIE SETS AND DIEMAKERS' SUPPLIES

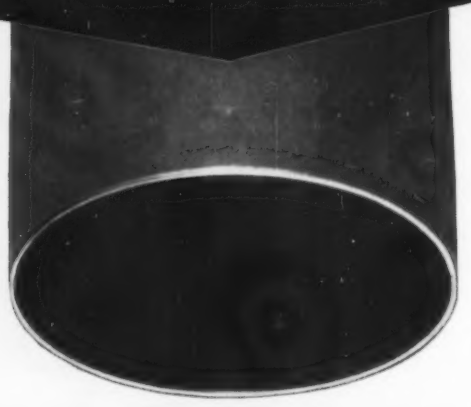
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Wales-Strippit Co., Akron, N. Y.

DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.

DIE STOCKS—See Stocks and Dies

BELIEVE IT OR NOT!

This tube end just left the Patented **WALLACE** Combination Cutting and Deburring Machine!



CUTS LIKE THIS IN SECONDS!

And you can do it in your own shop for lowest ultimate cost

WRITE for our FREE 44-page Wallace Cut-Machining book on cutting machines. 8 types—"tubes to plates."

Looking for answers? You'll find them here!

You can solve problems quickly with "A Manual of Processes." 200 pages, 148 pictures. You'll find clear, concise answers to: Why do bends wrinkle? Why do some bends break? What makes burrs in abrasive cutting? Why do abrasive wheels break at times? Which wheel is the right wheel? How fast can steel be cut? And hundreds of other shop questions.

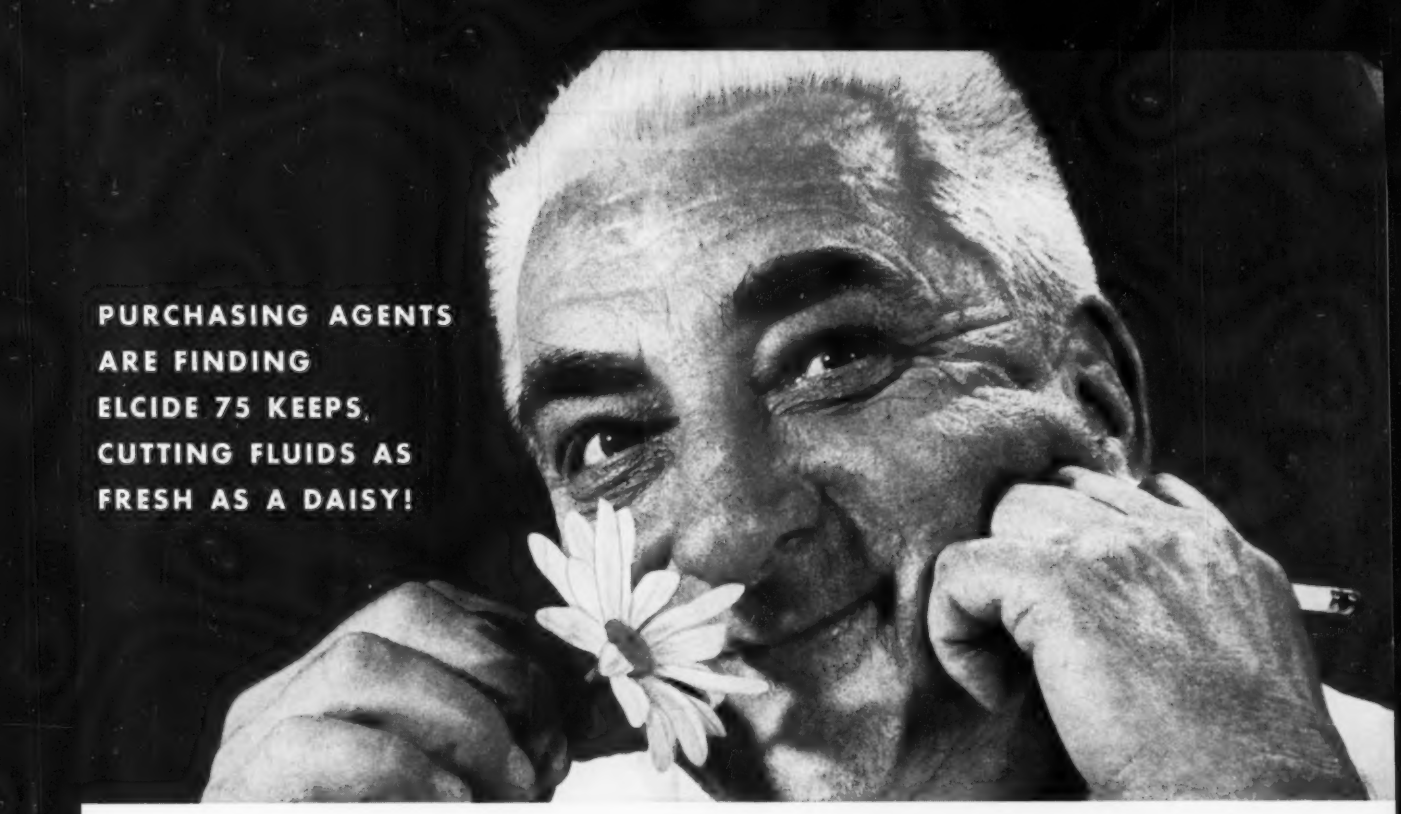
Only $3.00 (plus 30c postage). You save postage by sending cash with order.

ORDER YOURS TODAY!

WALLACE SUPPLIES MFG. CO.

1310 West Diversey Parkway • Chicago 14, Illinois

For more data, circle page number of this ad on inquiry card



ELCIDE 75™ extends the life of soluble oil emulsions

. . . lowers operating costs three ways

Less oil concentrate is purchased because standard duty emulsions last far longer when treated with one ounce of Elcide 75 per four gallons of emulsion.

Labor costs are reduced because less non-productive time is spent recharging machinery. The labor costs of disposal also decrease because there is much less waste-oil to be handled.

Production increases because machines are not shut down as often. Elcide 75 also contributes to better products and longer machine tool life by controlling the bacteria that may cause staining and corrosion. Employee efficiency improves, too, because Elcide 75 eliminates odor and controls bacteria that can cause skin infections.

Elcide 75 is more effective than other inhibitors because it is a combination of antibacterial agents, and includes a powerful new compound related to one of the safest, most effective bacterial inhibitors used in medical surgery. This combination controls a wider range of bacteria, including certain types that were resistant to commonly used germicides.

Elcide 75 controls harmful bacteria . . .

This photomicrograph shows one type of bacteria that enter emulsions through the air, water, and plant debris. They multiply rapidly and cause odor, staining, corrosion, and emulsion breakdown. Their damage costs the metalworking industry thousands of dollars each year.

Elcide 75 specifications: *Active Ingredients—Sodium Ethylmercuri Thiosalicylate (Thimerosal) and Sodium o-phenylphenate. Price per gallon—1-gallon polyethylene, $8.50, 5-gallon polyethylene, $8.00, 55-gallon stainless steel, $6.50. Sold only through selected distributors. For more information or to place your order, phone or write:*

ELCIDE 75™

PATENT PENDING

Lilly

Lilly's brand of bacterial inhibitor for cutting fluids

ELI LILLY AND COMPANY, AGRICULTURAL AND INDUSTRIAL PRODUCTS DIVISION, INDIANAPOLIS 6, INDIANA. TELEPHONE: MELROSE 6-2211

O.S.Walker

NEW 12"x24"

Permanent Magnetic Chuck

This new, large chuck from O.S.Walker gives you the greatest chuck capacity ever... 12 x 24 inches! Like other O. S. W. permanent ceramic magnetic chucks,* the new 1224 chuck has the most permanent magnets ever produced. They're *ceramic*, with many times the coercive force of alloy magnets. The face is *all steel*, with *no* soft insulating material.

Other important features include: low, low height, for extra machine capacity; fine pole divisions for maximum holding power; new, extremely stable "Niresist" body for greater rigidity.

All magnetic fields are controlled to prevent magnetization of the machine table or ways, as well as cutting tools. This feature, especially, makes the O. S. Walker 1224 Chuck ideal for milling and planing operations.

For details, call your local dealer or direct to O. S. Walker.

*Patent applied for

O. S. WALKER COMPANY, INC.

WORCESTER 6, MASSACHUSETTS, U. S. A.

The Original Designers and Builders of Magnetic Chucks

DIES, Blanking, Forming, Drawing, Extruding, etc.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell St., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Lettering and Embossing
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Self-opening Threading
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.

DISINTEGRATORS
Cincinnati Milling & Grinding Mchs. Inc., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

DIVIDERS AND TRAMMELS—See Layout and Drafting Tools

DIVIDING HEADS—See Indexing and Spacing Equipment

DOWEL PINS
Allen Mfg. Co., Bloomfield, Conn.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
DoALL Co., Des Plaines, Ill.
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

DRAWING COMPOUNDS
Oakite Products Inc., 26 Rector St., New York 6, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.

DRESSERS, Grinding Wheel
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.

DRIFT KEYS
DoALL Co., Des Plaines, Ill.

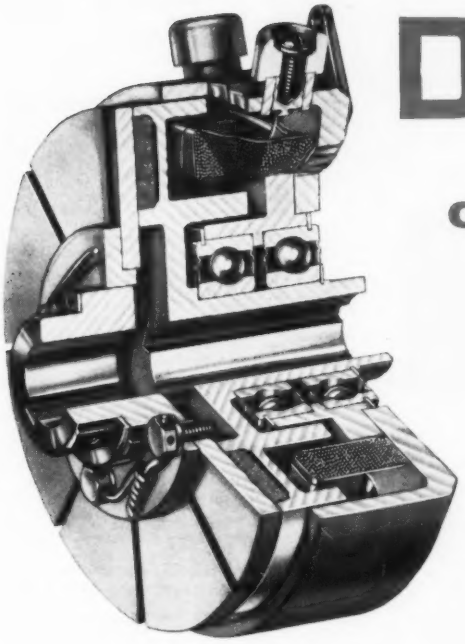
(Continued on Page 260)

For more data, circle page number of this ad on inquiry card

New—Small Sizes!

EATON DYNA-TORQ

MAGNETIC-FRICTION CLUTCHES and BRAKES



STATIONARY-FIELD, BEARING-MOUNTED DYNA-TORQ CLUTCH

Now Available in a Full Line from 1¾" to 15" Diameter

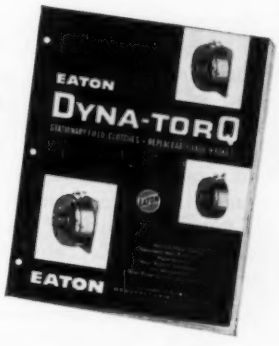
Eaton Dyna-torQ Magnetic-Friction Clutches and Brakes provide a simple, accurate, responsive method of controlling power and motion in today's complex production and processing machines.

The new smaller sizes and new design types of Dyna-torQ Stationary-Field Clutches and Brakes enable Eaton to offer a well rounded line, including flange-mounted and bearing-mounted clutches, and replaceable-face brakes. Unique features of design and construction result in worthwhile maintenance cost savings. Dyna-torQ units, easily and quickly installed on new machines or existing plant equipment, deliver many highly desirable advantages.

Dyna-torQ Magnetic-Friction Equipment Offers these Important Advantages:

- ★ Accurate power control
- ★ Dependable motion control
- ★ Rapid response
- ★ Easy "built-in" installation
- ★ Low maintenance costs
- ★ Compact plug-in type controls—may be remotely mounted
- ★ Inter-changeability of parts

Send for this new illustrated bulletin giving complete description and specifications covering Dyna-torQ Stationary-Field Clutches and Replaceable-Face Brakes.



Dyna-torQ Equipment is Available through Dynamatic Distributors in all Leading Cities

EATON

DYNAMATIC DIVISION
MANUFACTURING COMPANY
3307 FOURTEENTH AVENUE • KENOSHA, WISCONSIN

For more data, circle page number of this ad on inquiry card

DRILL HEADS, Multiple Spindle

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Delta Power Tool Div., 400 N. Lexington Ave., Milwaukee 10, Wis.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 387 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

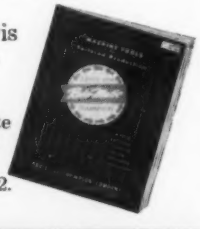
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Snow Manufacturing Co., Bellwood, Illinois.

Double End Threading of 280 Shafts per hour

. . . with Davis & Thompson Roto-Matic and Automatic Ejection

Here's another example of Davis and Thompson Engineering of high production with a minimum of equipment. This GG-8 horizontal threader is equipped with 4 spindles in each head and a 4 station fixture. It is one of countless threading machines that have been designed and built by Davis & Thompson since 1924. Both single and double end machines for pipe, conduit, shafts and similar parts in various production quantities have been produced.

If you have work of this nature, call in a Davis & Thompson Representative. There is no obligation for this service.



ADDITIONAL INFORMATION Get the complete story of the facilities available from Davis and Thompson. Write for this 8-page booklet today. Ask for Bulletin #1002.

Roto-Matic

Davis and Thompson Co.

4460 N. 124th ST. MILWAUKEE 10, WISCONSIN

DRILL SLEEVES AND EXTENSION HOLDERS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
National Automatic Tool Co., Richmond, Ind.
National Twist Drill & Tool Co., Rochester, Mich.

DRILLING ATTACHMENTS, Multiple Spindle—See Drill Heads, Multiple Spindle, and Vises, Machine

DRILLING AND BORING UNITS, Self-contained

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Automatic

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 12th St., Milwaukee 10, Wis.
Edlund Mchry. Co., Div., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olofsson Corp., Lansing, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit Corp., Akron, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 9th St., Hamilton, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.

DRILLING MACHINES, Deep Hole

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

(Continued on page 262)

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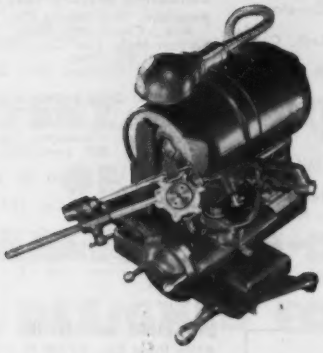
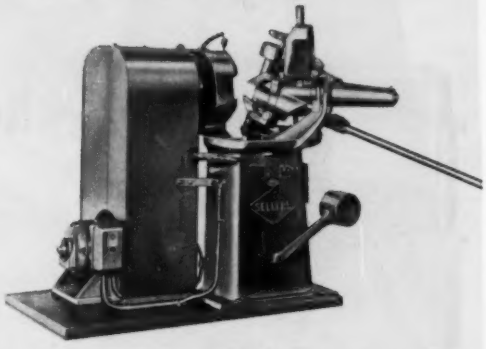


1-G The Sellers 1-G model is a small, self-contained, bench-type machine incorporating the same features as the larger Sellers grinders. Handles No. 70 to 1" drills. Bulletin 4102.

4-G The Sellers 4-G floor model is a dry grinder recommended for grinding 2-, 3-, or 4-lip, right-hand or flat twist drills up to 2" diameter. Puts correct grinding within the reach of small shops. Bulletin 4000.

6-GA The 6-GA floor model, wet, can lift the performance level of all your drilling equipment. It will grind 2-, 3-, or 4-lip, right-hand or flat twist drills, 3/16" to 3" diameter. Feed handwheel graduated in ¼ thousandths for grinding carbide drills. Bulletin 4201.



10-G Sellers 10-G machine is a self-contained wet grinder of the pedestal type. Remarkably free from vibration. Will grind either straight or tapered-shank, right-hand 2-lip and 4-lip twist drills in sizes from 1¾" to 5" diameter. Bulletin 4400.

FASTER, FINER DRILL-POINT GRINDING

yours...when you choose from the complete Sellers line

No manufacturer need pass up the advantages of scientific drill maintenance. The Sellers line includes drill grinders suited to the needs of all shops, both large and small.

These machines generate a scientifically correct drill point, with the lip clearance increasing proportionately from the periphery to the chisel point. This means drill points cut faster . . . drill through more inches of metal per grind . . . and produce holes that are true cylinders of accurate size.

Sellers grinders are ideal for both roughing and finishing work. Operation is easy—no skill is required to grind perfect drill points. There are so few moving parts that maintenance amounts to almost nothing.

Send for bulletins describing any of the Sellers drill grinders shown.

CONSOLIDATED MACHINE TOOL DIVISION
FARREL-BIRMINGHAM CO., INC.
Rochester 10, New York
Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

Consolidated®

CM-37

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Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippit Corp., Akron, N. Y.

DRILLING MACHINES, Gang, Multiple-spindle

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co., Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl & Eggleston Ave., Cincinnati, Ohio.
Carlton Mch. Tool Co., 2961 Meeker St., Cincinnati 25, Ohio.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Russell, Holbrook Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

NEW Gear Hobbing Machine Is Fully Automatic!

Koepfer 170 Gear Hobber

Koepfer 170

Hobbing of spur, helical and worm gears; worms; or any profile that can be generated . . .

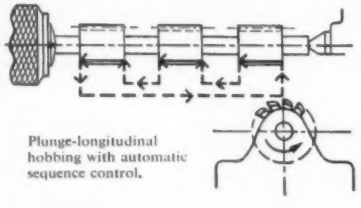
Magazine feeding attachment providing fully automatic loading, chucking and hobbing—greatly reducing machine set-up and handling time . . .

Semi-automatic operation for small runs—with foot pedal opening chucking device . . .

Automatic sequence control—permitting pre-selection by control switches for either longitudinal hobbing, plunge hobbing or combined plunge-longitudinal hobbing.

	without magazine feed	with magazine feed
Max. pitch to be cut	DP 10	DP 10
Max. dia. of blank	5⅛"	1¾"
Largest face	6"	4⅜"
Min. teeth to be cut	6(1)*	6(1)*

*Special attachment for cutting less than 6 to single-start worms


Plunge-longitudinal hobbing with automatic sequence control.

Write For Additional Information

COSA — *nationwide sales and service of precision machine tools —from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

DRILLING MACHINES, Sensitive

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, St., Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., Box 989, Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois.
Wales-Strippit Corp., Akron, N. Y.

DRILLING MACHINES, Universal Radial

Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.

DRILLING MACHINES, Upright

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit Corp., Akron, N. Y.

DRILLS, Center

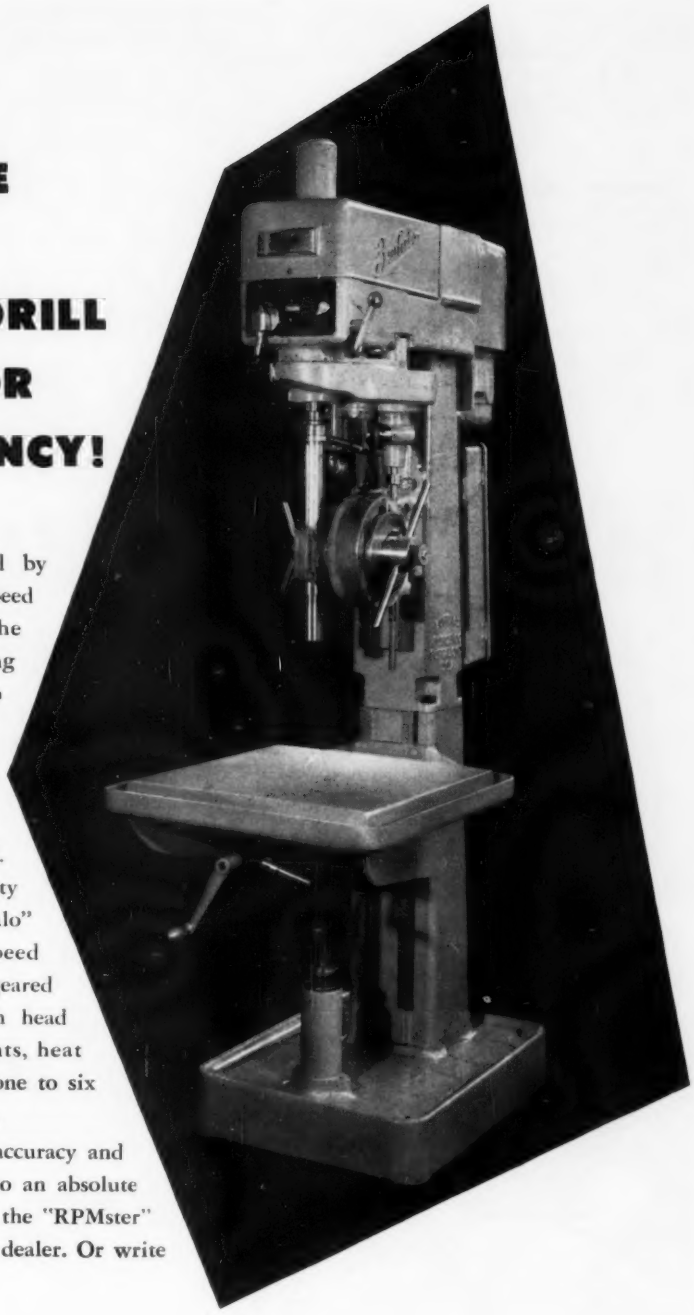
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

DRILLS, Core

Ace Drill Corp, Adrian, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.

For more data, circle page number of this ad on inquiry card

EVERY FEATURE OF THIS VARIABLE SPEED DRILL IS DESIGNED FOR OPERATOR EFFICIENCY!



Painstakingly engineered and handcrafted by "Buffalo" to create the finest variable speed drilling machine that money can buy, the "RPMster" sets a new standard of drilling ease and smoothness that's certain to increase the efficiency and output of your operators. A touch of the easily-reached controls on the head gives the operator instant and infinite speed changes ranging from 100 to 3000 RPM. Contributing to the accuracy, dependability and trouble-free long life of the "Buffalo" "RPMster" are the gearless variable speed drive — precision spindle — reliable, all-geared power feed — hand-scraped ways on both head and table — finest alloy steel components, heat treated prior to machining. Available in one to six spindle models, with tapping attachments.

For a totally new experience in drilling accuracy and operational ease, with vibration reduced to an absolute minimum, arrange for a demonstration of the "RPMster" with your nearby "Buffalo" machine tool dealer. Or write direct for Bulletin 3967-A

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

BUFFALO FORGE COMPANY

440 BROADWAY • BUFFALO, N. Y.

Canadian Blower & Forge Co. Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING BENDING

For more data, circle page number of this ad on inquiry card

DRILLS, Deep Hole, Gun
Ace Drill Corp., Adrian, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Oil Hole, Oil Tube
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Portable Electric
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

DRILLS, Portable pneumatic
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

DRILLS, Ratchet
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.

DRILLS, Subland
Ace Drill Corp., Adrian, Mich.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Twist, High-Speed Steel, Carbon Steel
Ace Drill Corp., Adrian, Mich.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Twist, Carbide, Carbide-Tipped
Ace Drill Corp., Adrian, Mich.
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Wire
Ace Drill Corp., Adrian, Mich.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.

DUPLICATING ATTACHMENTS—See Tracing Attachments

DUST COLLECTORS AND CONTROL SYSTEMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio.

ELECTRICAL DISCHARGE MACHINES
—See Distintegrators

ELECTRONIC CONTROL SYSTEMS
Electronic Control Systems, 2231 S. Barrington Ave., Los Angeles 64, Calif.

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine, Wis.

EXTRACTORS, Screw
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.

FACING HEADS
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

FASTENERS
Allen Mfg. Co., Bloomfield, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

ARMSTRONG

Drop Forged CLAMPS

LEADERS IN THE DROP FORGED CLAMP FIELD

. . . in design, machining and strength; in completeness of line in both sizes and types.

Designs are based on a full knowledge of clamp uses and requisites. Drop forging assures die-perfect form, texture toughness and freedom from structural faults. Maximum stiffness is attained by a discerning selection of steels with accurate controlled heat-treating, tempering and testing.

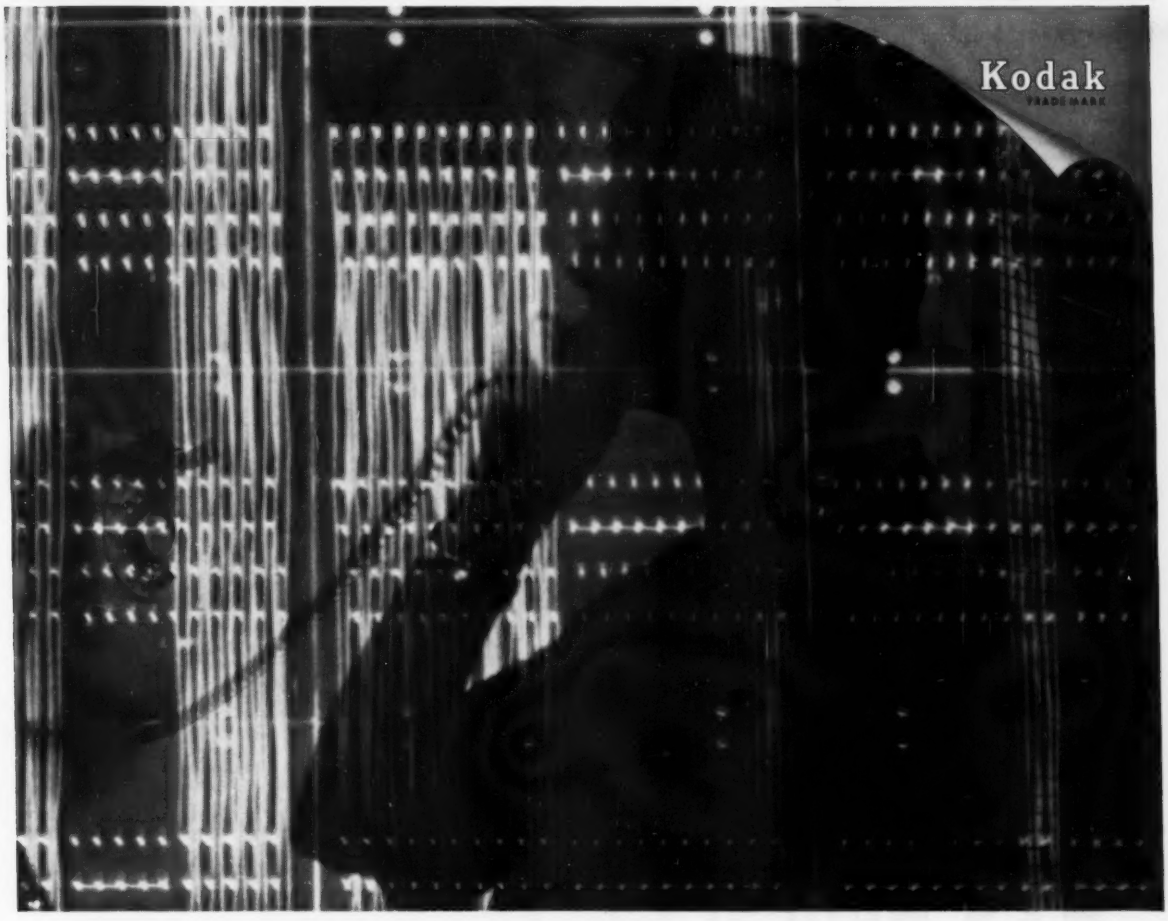
For dependability and long useful life, specify and standardize on ARMSTRONG Drop Forged Clamps.

Write for new ARMSTRONG General Catalog showing almost 5000 industrial tools

Buy ARMSTRONG TOOLS from your Industrial Distributor

ARMSTRONG BROS. TOOL CO.
5213 W. ARMSTRONG AVE. • CHICAGO 46, ILL.

For more data, circle page number of this ad on inquiry card



Here's a case where optical gaging is the only practical answer

The heart of the central dial switching system made by Stromberg-Carlson, Division of General Dynamics Corporation, is the XY* Universal Switch.

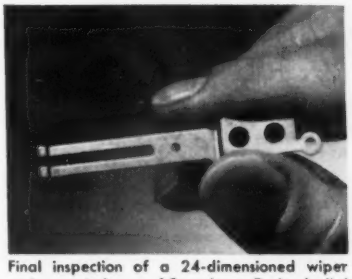
A key "muscle" in this heart is a small wiper spring, whose 24 exact dimensions resisted measurement by mechanical means. Yet any flaw in this critical component could seriously impair telephone service.

With the Kodak Contour Projector all 24 dimensions of this wiper spring are optically gaged to tolerances of ± .0005"—and the job takes just *three minutes*.

In this case Stromberg-Carlson found that optical gaging was the *only* practical inspection method. Special mechanical gages could have been devised, but then inspection would have taken—not three minutes—but as much as an hour per part.

Because Stromberg-Carlson makes and uses a wide variety of complex, hard-to-inspect products, the company uses 9 Kodak Contour Projectors in its Telecommunication Division, alone. They solve problems in receiving, production, and tool inspection as well as in final inspection.

If you have a gaging problem that involves close-tolerance measurement of precision parts with many dimensions, you can probably solve it best with a Kodak Contour Projector. To find out how optical gaging can help you, send for the booklet "Kodak Contour Projectors."



Final inspection of a 24-dimensioned wiper spring, a vital part of Stromberg-Carlson's dial switching mechanism, is practical only with optical gaging.

In another inspection area, an operator easily measures the critical dimensions of a relay lever arm with a Kodak Contour Projector to assure exact tolerances.

*XY is a registered trademark of Stromberg-Carlson

Apparatus and Optical Division

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

For more data, circle page number of this ad on inquiry card

Don't wait
till you need
Dependability-

Get it *now*
with

H & S Helical Gears

H & S Helical Gearing with overlapping tooth action is your ideal choice for power transmission on parallel shafts where speeds are high, where loads are high, and where smooth action is desired. Here's why —

- Correct machining of blank and accuracy of tooth generation reduce impact and increase load carrying capacity.
- Extra heavy rims, arms and hubs provide greater strength and stability.

H & S Helical Gears are available with diameters up to 125", 1 D.P. and 40" face.

It will pay you to learn more about the extra quality built into every H & S Gear. Send us your requirements. Quotations will be forwarded by return mail.

Send for your free copy of H & S Gear Catalog No. 57.

THE HORSBURGH & SCOTT CO.
GEARS AND SPEED REDUCERS
5112 Hamilton Avenue
Cleveland 14, Ohio

FEEDERS, Automatic
Gear-O-Mation Div., Michigan Tool Co., 7171 McNichols Rd., Detroit 12, Mich.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
V & O Press Co., Hudson, New York

FILES, Band
DoAll Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern
DoAll Co., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES AND BURRS, Rotary
DoAll Co., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES
Chicago Pneumatic Tool Co., New York 17, N. Y.
DoAll Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

FLAME-HARDENING MACHINES
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

FORGING HAMMERS, Steam and Air
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

FORGING MACHINES, Headers, Upsetters, Presses
Ajax Mfg. Co., 1441 Chardon Rd., Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd. S. W. Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
National Machinery Co., Tiffin, Ohio
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

FORGING, Hollow-Bored
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.

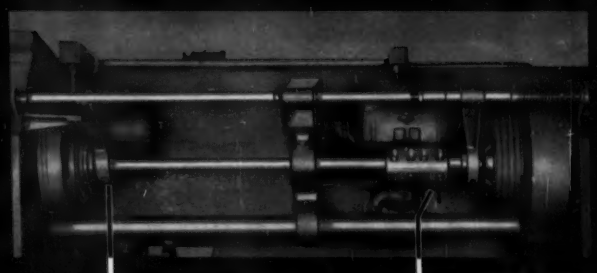
FORGINGS, Drop
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Wyman-Gordon Co., Worcester, Mass.

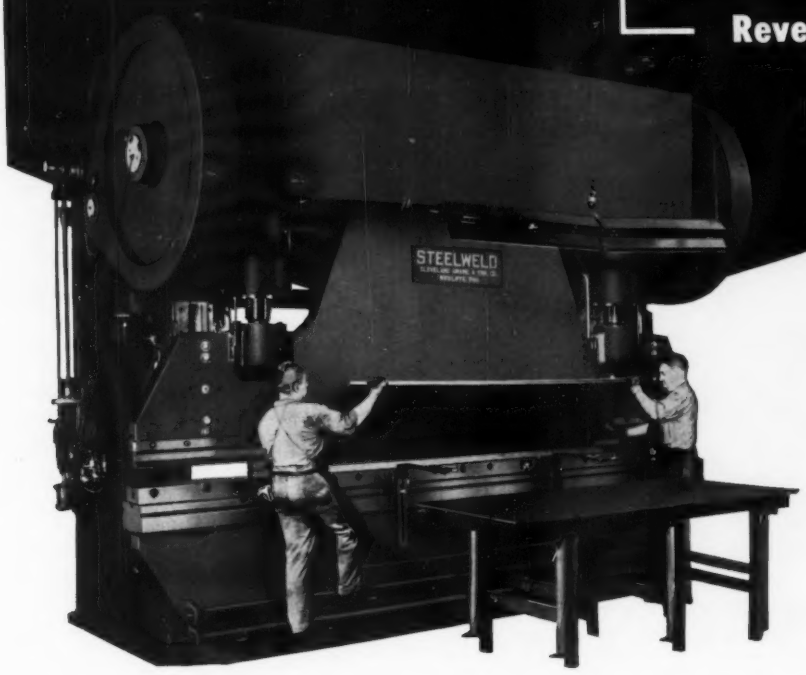
FORGINGS, Press
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)

FORGINGS, Upset
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.

For more data, circle page number of this ad on inquiry card

Reversing Ram Simplifies Press Operation





Model MO 6-12. Handles plate to 16'-6" x 7/16". Other Steelwelds available for working plate to 24 feet and thicknesses to one inch.

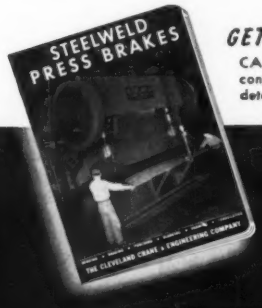
With a reversing ram drive you can back the ram or upper die away from the work at any point in the stroke. It is not necessary for the ram to continue through in one direction as when only the normal press drive is provided.

This feature speeds locating the correct ram position to achieve a specified bend or shape. It saves time and spoilage when trying new dies.

Reversing ram machines have two complete drives, including motor, flywheel and clutch. They are controlled by individual foot pedals on two different shafts, located one above the other across the front of the press.

The reversing ram feature is optional and may be provided on any Steelweld Bending Press. It adds greatly to the ease of operation and because of time-savings it enables, rapidly absorbs the extra original cost.

Steelweld Bending Presses are such versatile tools with so many outstanding features that we urge you to learn all about them. As a starter, send for the catalog below.



GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.
5457 East 281 Street, Wickliffe, Ohio

STEELWELD

PRESS BRAKES

BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

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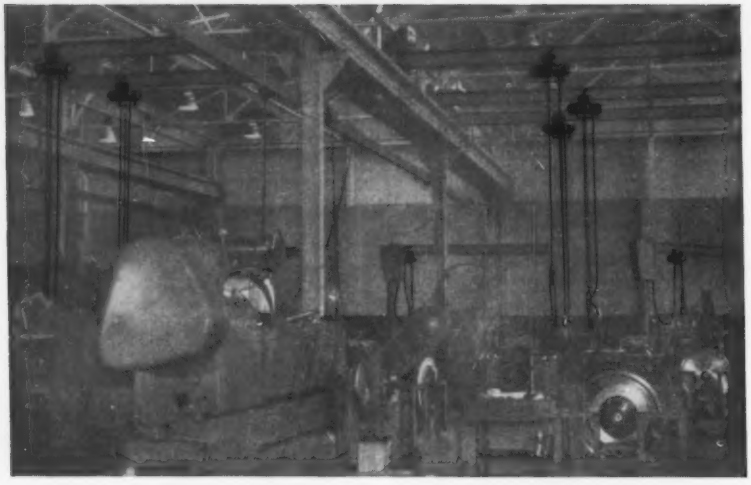
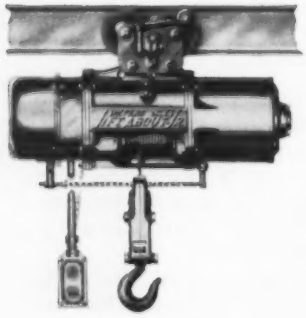
SHEPARD NILES

LIFTABOUT JR.

Moves more material and work-in-process

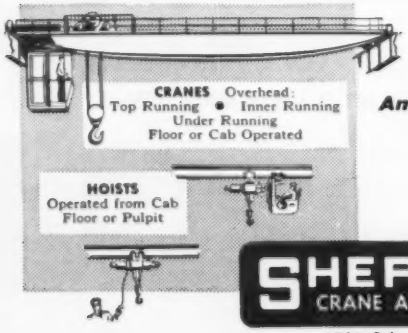
AT LOWER COSTS





ELIMINATE costly manual lifting and lugging . . . speed raw materials, work-in-process and finished products along your production line with a Shepard Niles LiftAbout, Jr. Low in cost, this rugged hoist will give many years of thrifty, dependable service.

Available in 250, 500, 1000 and 2000 lb. capacities . . . parallel or cross-mounted with bolt, hook or trolley suspension. Send for the LiftAbout, Jr. bulletin today . . . or ask to have a Shepard Niles representative call—there's NO OBILGATION.



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America's Most Complete Line

of Cranes and Hoists

Since 1903

SHEPARD NILES
CRANE AND HOIST CORPORATION

1598 Schuyler Ave., Montour Falls, N. Y.

FORMING MACHINES, Cold-Rolling

Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

FORMING MACHINES, Multiple-slide

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65 St., Chicago 38, Ill.
U. S. Tool Co., Inc., 255 North Main St., Ampere, E. Orange, N. J.

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air Comparator

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Automatic Sorting

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, DIAL, Bore, Height, Depth, Thread, Groove, etc.

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric Comparator

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Grinding

Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper Telescoping Thickness

Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, Multiple Inspection

Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

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SHELBY SEAMLESS TUBING

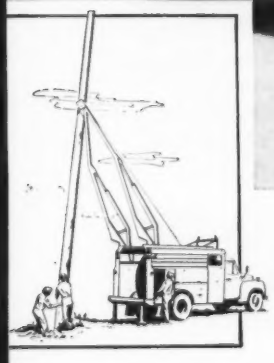
helps "Pole-Master"* handle poles like matchsticks

THE POWERFUL, two-legged boom of this "Pole-Master" Hydraulic Derrick is made of cold drawn tubes of USS Shelby Seamless Mechanical Tubing. Capable of handling poles up to 75 feet in length with relative ease, the boom is activated by two hydraulic cylinders, also of Shelby Seamless, which are powered by a heavy-duty hydraulic pump. The derrick has an operating arc of more than 180 degrees, and is designed to "set" poles or "pull" them from the ground. The "Pole-Master" can be used under the most severe work conditions in any weather or climate.

Here is an application in which Shelby Seamless Tubing really excels, for it brings into play all the desirable qualities that Shelby Seamless possesses—high strength, uniformity, shock absorbency, dimensional accuracy, lightness and workability.

Produced to exacting standards by the world's largest manufacturer of tubular steel products, Shelby Seamless is available in a wide range of diameters, wall thicknesses, various shapes and steel analyses. You are invited to call on our engineers for assistance. They will be happy to submit recommendations based on a study of your particular requirements.

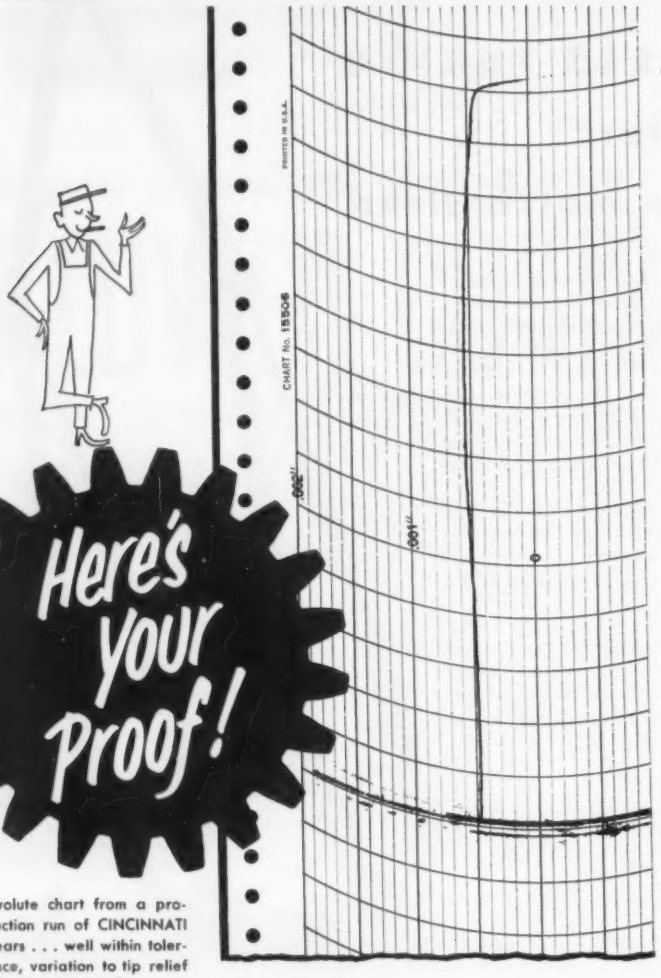
**Manufacturer's name on request.*



NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • United States Steel Export Company, New York

National Tube Division of USS United States Steel



Involute chart from a production run of CINCINNATI gears . . . well within tolerance, variation to tip relief is less than .0001".

The involute chart tells much about a gear. Accurately depicting tooth profile, this chart is interpretive of gear strength and ability to operate *quietly* with minimum wear. This chart is positive evidence of the degree of precision in gear manufacturing.

Involute charts are furnished at no extra charge with CINCINNATI gears . . . a part of our COMPLETE analytical inspection.

At Cincinnati Gear, the latest precision equipment enables us to make, inspect and *guarantee* custom gears—**and custom gear boxes.** We invite your inquiry.

CINTI® **GEARS,** good gears only

THE CINCINNATI GEAR CO.

Wooster Pike and Mariemont Ave. Cincinnati 27, Ohio

Custom Gear Makers Since 1907

GAGES, Plug and Ring

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Van Keuren Co., Watertown, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Roll Thread Snap, Adjustable Snap

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

GAGES, Surface Roughness

DoAll Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, VERNIER, Height, Depth, Gear Tooth

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Starrett, The L. S., Co., Athol, Mass.

GEAR BURNISHERS

Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHAMFERING, ROUNDING AND DEBURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHECKING EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Bevel and Spiral

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

(*Continued on page 272*)

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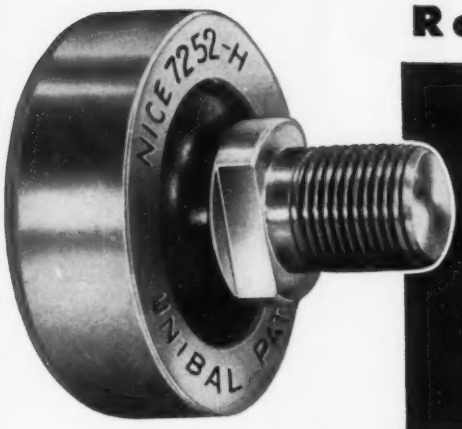
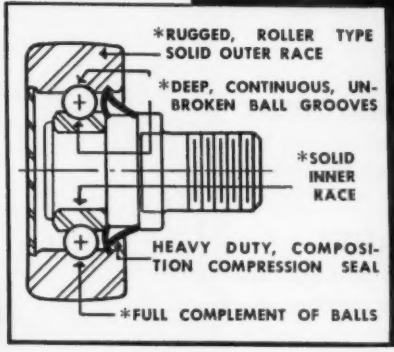
Revolutionary **NEW**

NICE BEARINGS

Meet...and Beat Tough Application Problems



No. 7252-H—Plunger Guide Roller for Hay Baler


*RUGGED, ROLLER TYPE SOLID OUTER RACE
*DEEP, CONTINUOUS, UNBROKEN BALL GROOVES
*SOLID INNER RACE
HEAVY DUTY, COMPOSITION COMPRESSION SEAL
*FULL COMPLEMENT OF BALLS

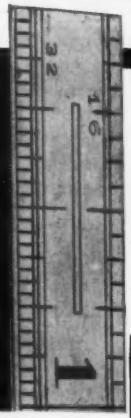
FIELD TESTED AND PERFORMANCE PROVED in a wide variety of tough applications... NICE now offers Product Designers the new and different UNIBAL® Ball Bearing. UNIBAL design and manufacturing methods (patent applied for), produce bearings of exceptional durability and strength. They feature solid inner and outer raceways with deep, unbroken ball grooves... there are no split races or loading slots, yet there is a full complement of balls.

NICE bearing No. 7252-H illustrates the ruggedness of the UNIBAL construction. The UNIBAL features of this plunger guide roller enable it to perform well under adverse conditions of heavy impact loading and a unique new composition seal design (patent applied for) effectively retains lubrication and excludes dust, dirt and moisture.

NICE ball bearings in this UNIBAL design are available in a wide range of sizes and types, with such features as extended races, snap rings, seals and shields. Your Inquiries are Invited.

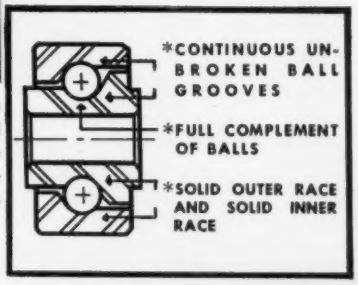
*Unibal FEATURES

Little Jobs can also be TOUGH



No. 6035-H—Cam Roller Operating Circuit Breaker on Accounting, Calculating and Tabulating Machines.

NICE No. 6035-H ball bearing is a small, but vital component. Its small size belies its ruggedness and durability under tough operating conditions... another example of UNIBAL superiority.



NICE®

NICE BALL BEARING COMPANY
NICETOWN · PHILADELPHIA · PENNSYLVANIA
DIVISION OF CHANNING CORPORATION

For more data, circle page number of this ad on inquiry card

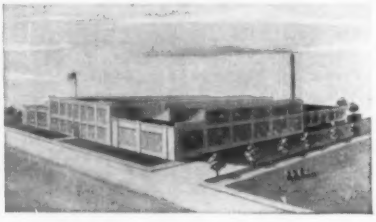
Here's how CDT can help you

CDT CAN INCREASE YOUR PRODUCTION
. . . because CDT specializes in designing and building tools and machines for today's high production demands.

CDT CAN IMPROVE YOUR QUALITY
. . . because CDT tools, jigs, fixtures and machines are precision engineered and built to the strictest requirements.

CDT CAN LOWER YOUR PRODUCTION COSTS
. . . by increasing the efficiency of your operation with special tools that do the job better—faster—more economically.

Call on Columbus Die-Tool for your special tooling problems. A large creative engineering staff with experience in developing special tools and machines for hundreds of industries is at your service. Over 50,000 square feet filled with precision production equipment enables us to build fine tools and special purpose machines to exacting requirements. Avail yourself of the industry-wide experience of Columbus Die-Tool.



FREE: *New brochure listing facilities, equipment, etc. Write today.*

Columbus Die-Tool
AND MACHINE COMPANY
P.O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR GRINDERS—See Grinding Machines, Gear

GEAR HOBBERS
American Schiess Corp., 1232 Penn. Ave., Pittsburgh 22, Pa.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

GEAR HONERS
National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.

GEAR LAPPERS
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 12, Mich.

GEAR MOTORS—See Speed Reducers

GEAR RACKS
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Stahl Gear & Mch. Co., The, 3901 Hamilton Ave., Cleveland 4, Ohio

GEAR SHAPERS
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

GEAR SHAVERS
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEARS, AND GEAR BLANKS, Nonmetallic
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Marie-mont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
New Jersey Gear & Mfg. Co., Hillside, N. J.
Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

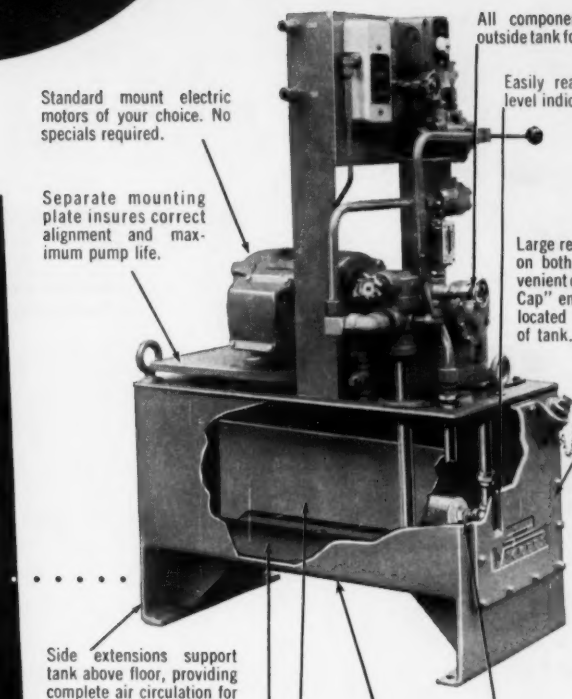
GEARS, Cut
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Marie mont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio.

(*Continued on page 274*)

For more data, circle page number of this ad on inquiry card

You save money and time applying Hydraulics when you buy the . . .

VICKERS *package . . . . . instead of parts*

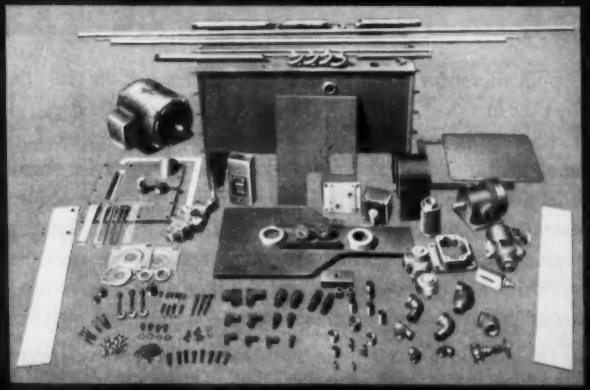

All components mounted outside tank for easy access.
Easily read accurate fluid level indicator.
Standard mount electric motors of your choice. No specials required.
Separate mounting plate insures correct alignment and maximum pump life.
Large removable covers on both ends for convenient cleaning. "Filler Cap" end cover can be located at either end of tank.
Side extensions support tank above floor, providing complete air circulation for maximum heat rejection.
Corrosion protection—internal tank surfaces sand-blasted and specially painted.
Inlet strainers can be removed and cleaned without disconnecting components or pressure piping.
New baffle plate improves fluid circulation.
Easy accessibility to drain plug.

Vickers Custom Built Power Package . . . complete . . . factory pretested . . . ready to connect and operate.

You save time and expense of design, layout, multiple purchasing, and assembly when you buy the Vickers package. You are assured of component compatibility and Vickers undivided responsibility and guarantee for the entire hydraulic package.

A Vickers Custom Built Hydraulic Power Package is a "complete unit" . . . factory pretested, ready for you to connect and operate. Designed and professionally built to your specifications.

Call in a Vickers Application Engineer or write for Bulletin 5001B.



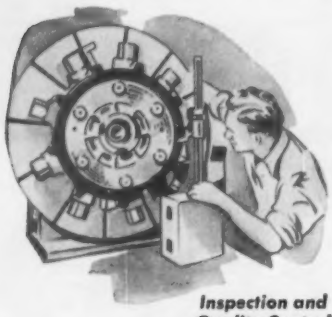
These parts are required to build the Power Package shown above. Purchasing the complete package from Vickers saves you the time and cost of design, assembly, and testing. It also assures the most suitable unit for your particular requirements.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1403 • Detroit 32, Michigan

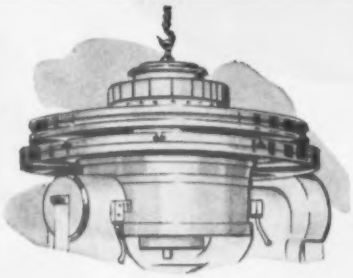
Application Engineering Offices: ATLANTA • CHICAGO* • CINCINNATI • CLEVELAND • DETROIT* • GRAND RAPIDS • HOUSTON • INDIANAPOLIS • LOS ANGELES AREA (El Segundo)* • MILWAUKEE • MINNEAPOLIS • NEW YORK AREA (Springfield, N.J.)* • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE* • ST. LOUIS • TULSA • WORCESTER • Factories also in: Australia, England, Japan and Germany • In Canada: Vickers-Sperry of Canada, Ltd., Toronto,* Montreal and Vancouver
Field Service Headquarters Underlined. Whse. Stock & Repair Branches*.

8155

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

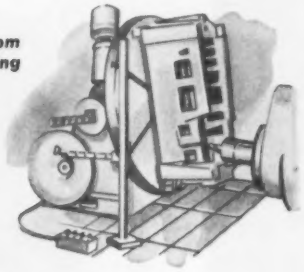


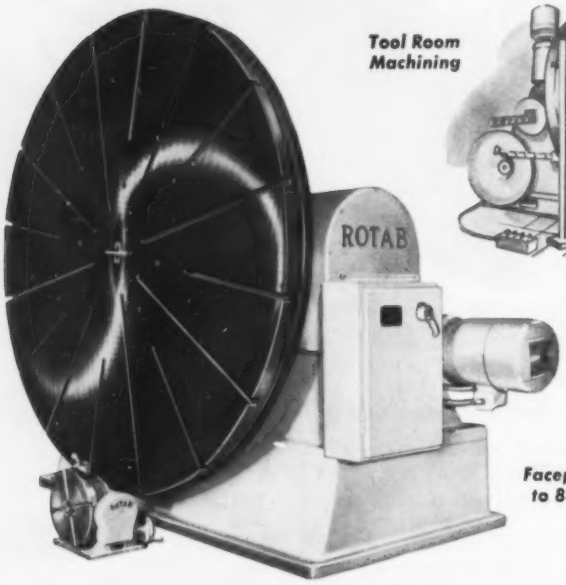
Inspection and Quality Control



Experimental and Tool Room Layout

Tool Room Machining





Faceplates from 12" to 84" in diameter

APPLICATIONS UNLIMITED... ROTAB© UNIVERSAL TABLES

Applications for *ROTAB* precision tables are, in fact, limited only by user imagination. For *ROTAB* units are being successfully utilized for receiving, tool and gaging, stage and final inspections, and for analytical spot checks on parts in process. *ROTABs* are proving highly effective in quality control for statistical data procedure, quality, casting and pattern analyses. They're saving time, increasing accuracies in experimental and tool room layout, too. And they've even performed outstandingly as cost-cutting machining fixtures for high accuracy positioning of difficult and complex tool room operations.

How does *ROTAB* come by this versatility? By offering single set-up, 3-dimensional positioning with optically precise 5-second accuracy, motor-driven,pendant controlled movement, horizontal loading and many more advanced engineering features. *You* can use *ROTAB*, and we can show how.

Write today for your catalog!

MACHINE PRODUCTS *Corporation*

6771 E. McNICHOLS ROAD • DETROIT 12, MICHIGAN

Horsburgh & Scott Co., 5114 Hamilton Ave., Cleveland 14, Ohio
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
James D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

GENERATORS, Electric

Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

GRADUATING MACHINES

Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.

GREASES—See Lubricating Oils and Greases

GRINDERS, Bench, Floor and Snag

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Jones & Lamson Mch. Co., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Carbide Tool

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Rooseve't Park Annex, Detroit 32, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Die and Mold

Norton Co., 1 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Drill Point

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Oliver Instrument Co., 1410 E. Maumee, Adrian, Mich. (also drill point thinner)
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.

GRINDERS, Face Mill

Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDERS, Knife and Shear

Hill Acme Co., 1201 W. 65th St. Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

For more data, circle page number of this ad on inquiry card

Strength

that comes only from forging and rolling

Strength is the first requirement of any crane wheel. Nothing else counts quite so much. This wheel has it.

The wheel was machined from a Bethlehem forged-and-rolled blank—a unique type of blank that is strong all over, and all the way through.

Bethlehem's forging-and-rolling method produces blanks with excellent grain flow and freedom from porosity. The metal down inside, as well as on the surface, is of uniform quality. This makes the machinist's job easier; he can work with confidence. The blanks can be turned, bored, faced, and hobbed with complete assurance of a good finished product.

You can obtain Bethlehem forged-and-rolled blanks in a wide range of sections, and in sizes from 10 to 46 in. OD. Use them when making crane wheels, gears, flywheels, pipe flanges, turbine rotors, sheave wheels, and similar items. Prices are competitive.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

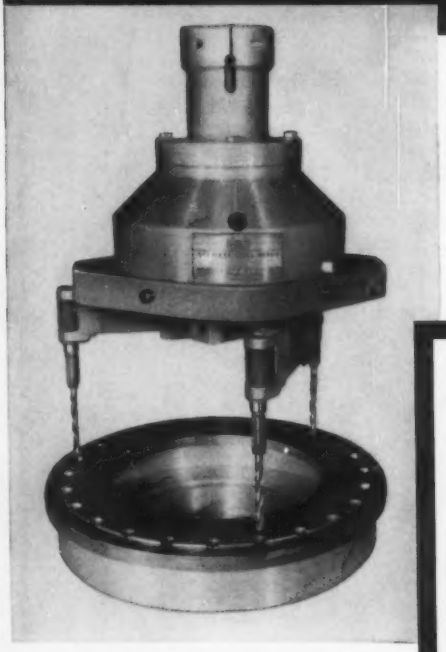
On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

NOW - Zagar

presents a NEW CONCEPT of a MULTI-SPINDLE ADJUSTABLE HEAD



for

- *DRILLING*
- *TAPPING*
- *and REAMING*

Bolt circles up to 23" dia. allow virtually limitless inner hole patterns.

Here's an adjustable, multi-spindle head packed with features never before combined in a single tool. Zagar's famous, soundly engineered gearless drill head principle is applied to adjustable spindle drilling. There are NO universal joints, NO flexible shafts, NO bulky gear clusters.

The head is ready to use on any standard drill press for any machinable material. No auxiliary parts are needed. Spindle arms can be removed and replaced in minutes. Hole patterns can be changed as easily as spindles and at little cost.

Before you drill another hole, contact a Zagar representative, and—

Write for Data Sheets 93-M-12.

Zagar

ZAGAR, INCORPORATED
23888 LAKELAND BLVD.,
CLEVELAND 23, OHIO

TOOLS FOR INDUSTRY and SPECIAL MACHINERY

GRINDERS, Portable Pneumatic
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Madison-Kipp Corp., Madison, Wis.

GRINDERS, Tap
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDERS, Tool and Cutter
Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co. Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

GRINDERS, Toolpost
Cosa Corp., 305 Lexington Ave., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding

GRINDING MACHINES, Abrasive Belt
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Broach
Gallmeyer & Livingston Co., 336 Straight, S. W. Grand Rapids 2, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

GRINDING MACHINES, Cam
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Centerless
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Crankshaft
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

For more data, circle page number of this ad on inquiry card

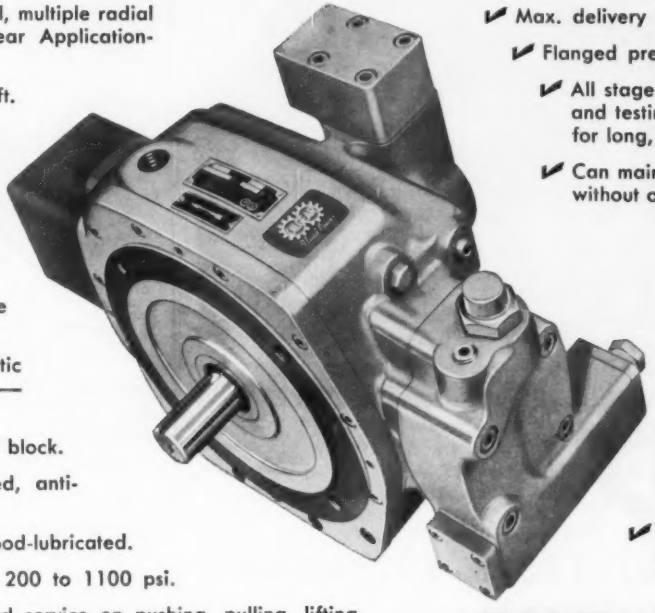
. . . Fluid Power news

NEW RADIAL PISTON VARIABLE DISPLACEMENT PUMP

OILGEAR ANNOUNCES NEW "Power-Saver" PUMPS

New Type "ANP" Pumps Generate Only Needed Power — Boost System Efficiency

- Simple, one piece, alloy steel, multiple radial rolling pistons — an Oilgear Application-Proved, exclusive design.
- One-piece cylinder and shaft.
- Balanced flat valve (port plate) and separate wear plate to assure a controlled oil film between working surfaces . . . high volumetric efficiency over entire pressure range.
- Integral, adjustable volume control.
- Integral, adjustable, automatic pressure unloading control — 200 to 1100 psi.
- Precision, bearing-type slide block.
- Large, conservatively loaded, anti-friction bearings.
- Completely pressure and flood-lubricated.
- Working pressure range — 200 to 1100 psi.
- Built for continuous, full-load service on pushing, pulling, lifting, lowering applications . . . on machines requiring positive, static loads over intermittent or long periods . . . for automatic charging of accumulator systems . . . for repetitive "ON-OFF" loads up to 1100 psi. New Oilgear type "ANP" pumps will perform more efficiently — with less heat generation — on presses, machine tools, transfer machines, hold-downs, injection molding, die casting — and other machines.



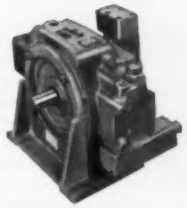
- Max. delivery to 3100 cipm (13½ gpm).
- Flanged pressure and suction ports.
- All stages of manufacturing, assembly and testing under strict quality control for long, dependable service life.
- Can maintain a static load indefinitely without overload or excessive heating.
- Adjust pump volume to suit optimum ram speed — no excess oil to "wire-draw," blow past a relief valve or generate heat.
- Adjust pressure to maximum force needed. When this preset pressure is reached, control automatically reduces pump to slip stroke to save power — reduce heat.
- Available clockwise or counterclockwise rotation at no extra cost.

For complete data on these new "Power-Saver"—Oilgear type "ANP" Pumps — call the factory-trained Oilgear Application-Engineer in your vicinity. Or write, requesting your copy of Bulletin 47550 — stating your specific requirements directly to . . .

SELECTION OF MOUNTINGS

Pump case has an accurately finished round face for:

1. Mounting direct to machine. (above)
2. Mounting to a right-angle bracket for "foot-mounting." (right)
3. Mounting to a round adapter for NEMA type "C" electric motor frames.
4. As Standard and "Custom-Built" "Power-Paks"—(right) . . . . complete, compact sources of Fluid Power. Standard "Pak" consists of "ANP" Pump with round adapter or right-angle bracket, coupling, electric motor, 23-gallon differential capacity welded steel base, piping, air breather, filling strainer, fluid level gauges, baffles, clean-out covers, drain plugs, auxiliary pipe connections, and mounting and leveling lugs.

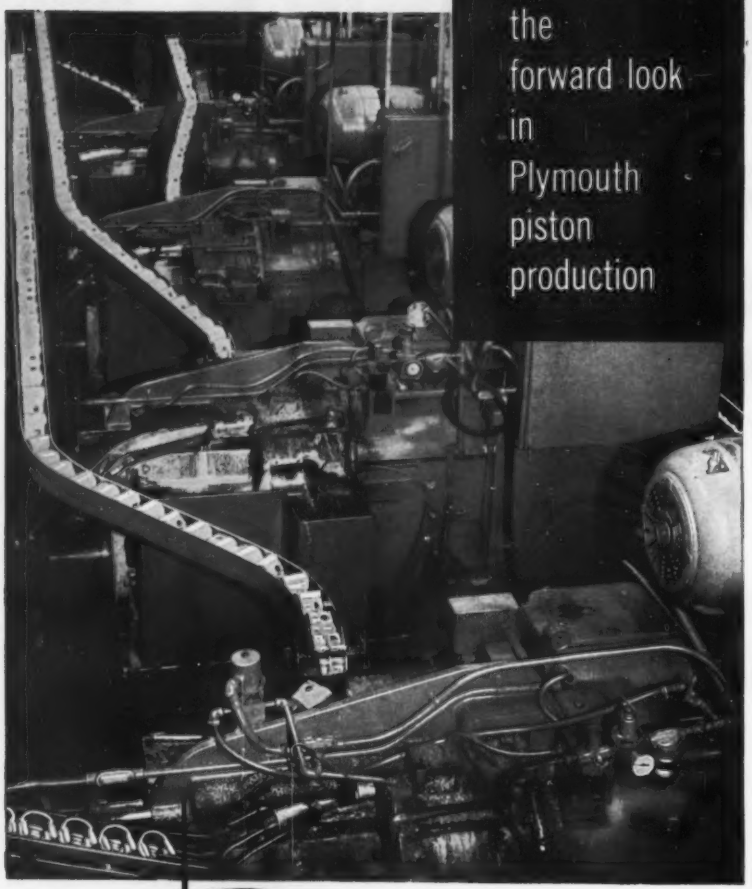


Oilgear's *"Power-Saver"* Pumps and simplified circuitry reduces engineering, production and assembly costs . . . promotes safety, improves performance and system efficiency.

THE OILGEAR COMPANY

Application-Engineered Controlled Motion Systems

1569 WEST PIERCE STREET · MILWAUKEE 4, WISCONSIN



Features **BAIRD**

COMPLETELY AUTOMATIC
HIGH PRECISION
CHUCKERS

Four Baird Model 76H Automatic Chuckers, at Chrysler Corporation's Mound Road Engine Plant, handle *all* Plymouth pistons on this new mechanized production line.
They rough and finish two cuts on the O. D.; rough and finish ring grooves; rough and finish two cuts on the dome; chamfer skirt and dome; face to length. With auto load and unload, aluminum pistons are finished in 8 seconds.
Chrysler Corporation is a long-time Baird chucker customer. Chrysler engineers know that Bairds meet the requirements in machining speed . . . in close tolerance quality of work produced . . . and in freedom from down-time.
If you can use the exceptional capacity and low-cost productivity of Baird 6-spindle and 8-spindle chuckers, write Dept. M for more information.

THE BAIRD MACHINE COMPANY
STRATFORD • CONNECTICUT

BAIRD — Six and Eight Spindle Chuckers • Automatic Multiple Traverse Presses • Automatic 12 Station Duplex Turning Machines • Vertical Continuous Lathes • Automatic Four Slide Machines • Pressformatic Ribbon Metal Forming Machines • Barrel Finishing Machinery • Machinery for Chain and Roller Chain Production, Garment Hook and Eye Production • Precision Bench Presses

58A58

GRINDING MACHINES, Cylindrical

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Disc

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Gear

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Internal

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co. 2488-90 River Rd., Cincinnati, Ohio.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES—Jig

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Gallmeyer & Livingston Co., 336 Straight S.W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

GRINDING MACHINES, Profile

American Laubscher Corp., Fisk Bldg., 250 W. 57 St., New York 19, N. Y.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Roll

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Surface Reciprocating

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
DoALL Co., Des Plaines, Ill.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio
Gallmeyer & Livington Co. 336 Straight, S.W. Grand Rapids 4, Wis.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

For more data, circle page number of this ad on inquiry card

Bridgeport

TURRET MILLING MACHINES

Exclusive features and practical attachments provide greater versatility, accuracy and productivity

To the many exclusive features offered in the basic "BRIDGEPORT," should be added attachments which increase versatility and all-around handling convenience.

Modern design plus the finest in production equipment methods are available on a moderate investment. "BRIDGEPORTS" are *THE* machines for modern, accurate, milling, boring, shaping, cherrying and copying . . . for use in any shop, large or small.

Among recent developments are increased cross travel, 3-dimensional hydraulic tracing and a new optical measuring system which simplifies and improves jig boring. These features extend the utility of BRIDGEPORT TURRET MILLING MACHINES and provide greater versatility, capacity and precision.

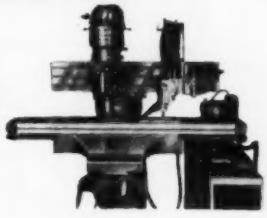
And of equal interest to shopmen everywhere, our expanded production facilities now make it possible to ship "BRIDGEPORTS" to suit your needs. Investigate.

ATTACHMENTS and ACCESSORIES
to increase versatility

Milling, Drilling and Boring Attachments: Model "J" 1 HP; Model "M" ½ HP; Model "R" ½ HP; and Model "C" ¼ HP (Rigid Spindle)

- Cherrying Attachment
- Slotting Attachment
- Power Feed
- Measuring Attachment (Rods and Indicators)
- Optical Measuring System (a recent addition to the Bridgeport line)
- Hydraulic Duplicators (Single Dimension and Three Dimension)
- Coolant Pump
- Four-Inch Raising Block
- Seven-Inch Raising Block
- Cross Travel Stops
- Lights
- Right Angle Attachments Nos. 1, 2, 3
- Shell Mill Holders Nos. 1, 2, 3
- Fly Cutters, FC-3, FC-4
- Threaded Arbors
- Stub Arbors
- Vises No. 1 and 2 (Swivel and Plain)
- Profilers for Model "J" and "M" Heads
- Boring Heads Nos. 1 and 2
- Collets
- Chucks (Jacobs and Albrecht)
- End Mill Holders
- Spindle Adapters

NEW BRIDGEPORT 3-D T-RAM HYDRAULIC TRACING MACHINE



Unexcelled for accuracy, speed and ease of performance. Equipment integral with basic machine. Designed so that 2 or 3 milling attachments can be mounted working simultaneously for multiple piece production in a single operation. T-Ram greatly increases capacity.

Ask us or your nearest dealer for more complete details

Bridgeport MACHINES, INC.

Bridgeport, Connecticut

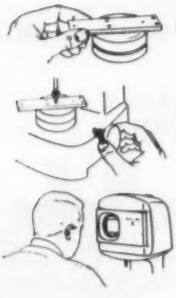
Manufacturers of High Speed Milling Attachments and Turret Milling Machines

New! BAUSCH & LOMB DR-25 OPTICAL GAGE

Direct scale reading to .0001" ...

0" to 3" range ... accurate to .000025"!

FAST, EASY AS A-B-C!



A Just set part to be measured on anvil ... no masters or set gages needed. Large work table makes it easy to adapt special fixtures, accommodates widest variety of work.

B Turn knob to lower spindle ... it will stop automatically on contact, with constant spindle pressure.

C See precise measurement at a glance ... direct-reading scale is illuminated, magnified. No eyestrain, no conversion, no guesswork. Dependable measurement of depth, thickness, height, diameter, taper, angularity of surfaces, runout.

ONLY $695 COMPLETE

On-the-job demonstration! JUST MAIL THE COUPON TODAY!

Distributed in the U.S.A. through the DoALL Co.

BAUSCH & LOMB OPTICAL CO.
85436 St. Paul St., Rochester 2, N. Y.

☐ I'd like a free on-the-job demonstration of the new B&L DR-25 Optical Gage, with no obligation on my part.

☐ Please send Catalog D-285.

Name .....

Company ..... Title .....

Address .....

City ..... Zone ..... State .....

BAUSCH & LOMB SINCE 1853

GRINDING MACHINES, Surface Rotary
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Walker, O. S. Co., Inc., Worcester, Mass.

GRINDING MACHINES, Thread
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mch.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Parker-Majestic, Inc. 147 Joseph Campau, Detroit, Mich.

GRINDING WHEEL DRESSING AND FORMING DEVICES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoALL Co., Des Plaines, Ill.
Jones & Lamson Mch. Co., Springfield, Vt.
Metal Carbides Corp., Youngstown, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING WHEELS
Bay State Abrasive Co., Westboro, Mass.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Delta Power Tool Div., 400 N. Lexington Ave Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., Beloit, Wis.
Metal Carbides Corp., Youngtown, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.

HAMMERS, Drop—See Forging Hammers

HAMMERS, Portable Electric
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HAMMERS, Portable Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

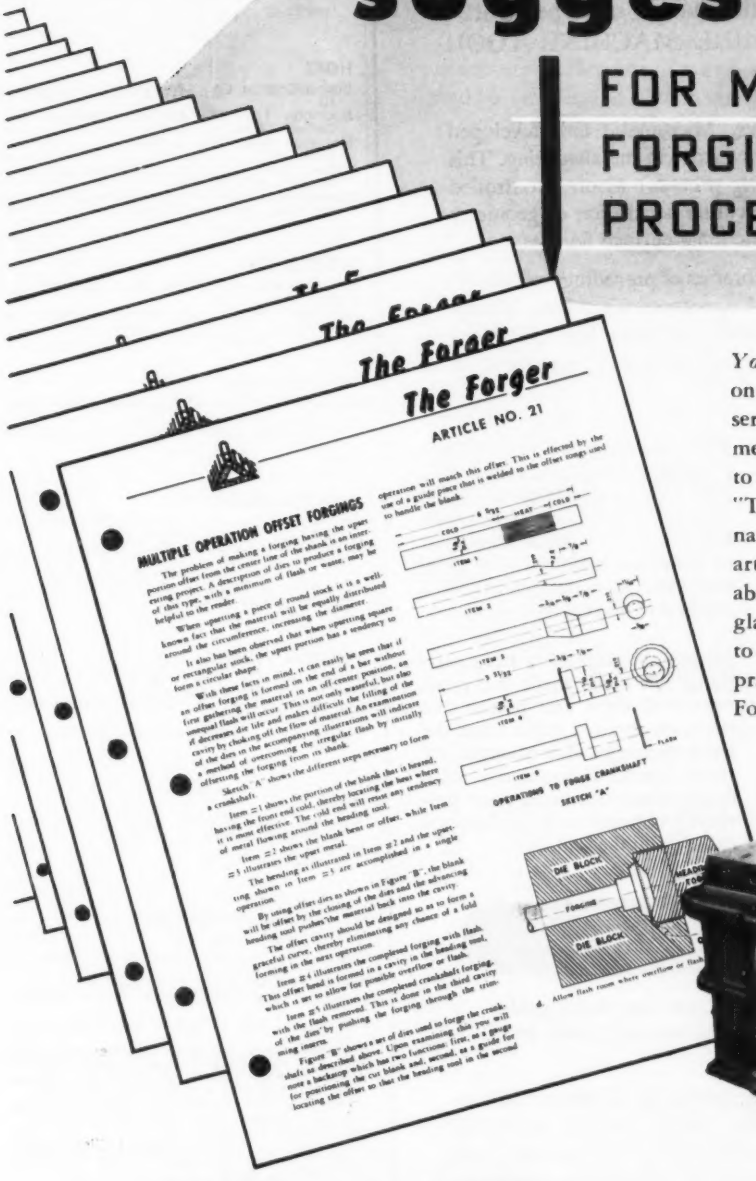
HAMMERS, Power
Chambersburg Engrg. Co., Chambersburg, Pa.
Edlund Mchry. Co. Div., Cortland, N. Y.

(Continued on page 282)

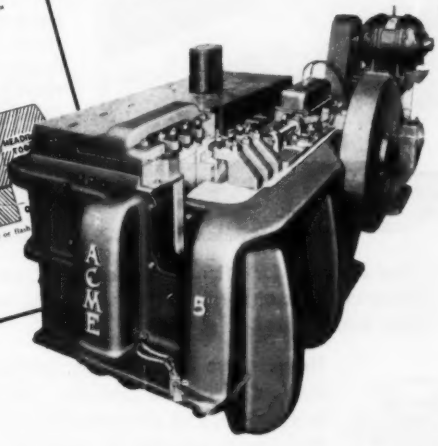
For more data, circle page number of this ad on inquiry card

helpful suggestions

FOR MODERN FORGING PROCEDURE



You are invited to have your name placed on our mailing list to receive this valuable series of articles on up-to-date forging methods and procedures. We will be glad to send a complete set of twenty one issues of "The Forger" in addition to placing your name on our mailing list to receive future articles as they are prepared. There is absolutely no charge for this service. We are glad to make this good will contribution to the advancement of modern forging practice as executed on ACME XN Forging Machines.



The HILL ACME Company

1207 W. 65th STREET • CLEVELAND 2, OHIO

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING & POLISHING MACHINES
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES

For more data, circle page number of this ad on inquiry card

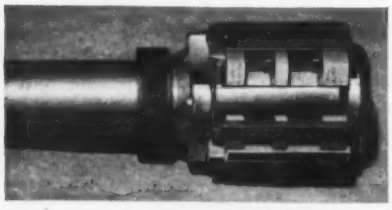
WHY MICROHONING* TOOLS ASSURE

ECONOMY — PRECISION — PRODUCTION

COST FACTORS (labor, maintenance, scrapped parts, productivity, etc.) DETERMINE MACHINE TOOL EFFICIENCY.

To Minimize These Cost Factors, Micromatic has developed Microhoning tools that offer a new concept in metalworking. This concept (known as the Microhoning process) assures controlled abrading, efficient stock removal, accurate generation of geometry and size, and produces uniform, functional surface finishes.

Because Microhoning removes inaccuracies of preceding operations, it is usually the final stock removal operation. Therefore, Microhoning tools are designed and applied to produce high precision, assure a minimum of scrap and protect the user's investment in previous processing operations.



New! Tru-Float tool has a universal joint within the abrading unit. This design provides maximum accuracy and float, uniform abrading and surface finish, less wear of abrasives, retention of original bore location, and minimum stock removal to correct inaccuracies.

Micromold assemblies have plastic or soft metal shells that minimize tool wear and protect the edges of abrasive sticks from the harsh dressing action of extremely rough bores. This abrasive stick design eliminates many parts previously required to hold abrasives and expand the tool.

Tool designed for Microhoning tandem bores has plastic guides between banks of abrasives to stabilize the tool as it passes over bore interruptions.

Because use of the proper tool is so important, Micromatic designs Microhoning tools to suit the individual work piece, and integrates tool design with machine and fixturing to provide the ultimate in operating efficiency.

**Registered U.S. Pat. Off.*

MICROMATIC HONE CORP.

8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

Erie Foundry Co., 1253 W. 12th St., Erie Penna.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio.

HARDNESS TESTERS
Shore Instrument & Mfg. Co., 90-35C Van Wyck Exp., Jamaica 35, N. Y.

HEAT-TREATING EQUIPMENT — See Annealing Furnaces, Flame Hardening Machines, Induction-Heating Equipment

HOBS
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. Y.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

HOISTS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HOISTS, Electric
Ingersoll-Rand Co. 11 Broadway, New York 4, N. Y.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

HONING MACHINES
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Jes-Cal Co., Fraser Michigan
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Moline Tool Co., 102-120th St., Moline, Ill.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

HONING STONES
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Jes-Cal Co., Fraser, Michigan
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.

HOSE
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

HYDRAULIC MACHINERY
Tools and equipment
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., E. W. Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., Erie, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.
Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Div. of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

INDEXING and SPACING EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.
Vinco Corp., 9111 Schaefer Highway, Detroit,

INDICATOR BASES, Magnetic

Brown & Sharpe Mfg. Co., 235 Promenade St., Provicence 1, R. I.
DoALL Co., Des Plaines, Ill.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, L. S. Co., Athol, Mass.

INDICATORS, Dial

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
National Automatic Tool Co., S. 7th - N. Sts., Richmond, Ind.
Starrett, The L. S. Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Starrett The L. S., Co., Athol, Mass.

INDICATORS, Test

Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
National Automatic Tool Co., S. 7th & N. Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lepel High Frequency Laboratories, Inc., Woodside 77, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

INTENSIFIERS, Hydraulic

Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St. Milwaukee 4, Wis.

JACKS, Planer—See Set-up Equipment

HOW MICROHONING* TOOLS PROVIDE

ECONOMY—PRECISION—PRODUCTION

When a precision stock removal process minimizes cost factors (labor, maintenance, scrapped parts, etc.) then volume production at lower cost per piece is possible. Here's how the distinctive design and performance of Microhoning tools provide all three—economy, precision and production.

EFFICIENT OPERATION

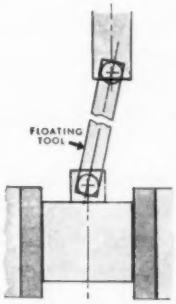
Micromatic expands, rotates and reciprocates the abrading tool in the bore. Through this controlled combination of pressure and movements, abrasives are self-dressing for effective and continuous cutting action. Long abrasive sticks are evenly spaced around the tool to keep it stable. They effectively bridge surface irregularities and generate a geometrically true cylinder.

REDUCES OPERATOR COSTS

Micromatic "Adjusting Heads" give operator complete and positive control of tool expansion. Or, automatic controls can be used to perform all tool adjustment and gaging. They assure accurate duplication in every part produced.

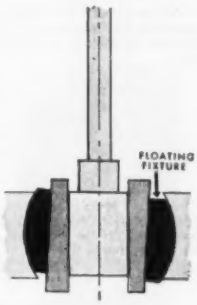
MINIMUM MAINTENANCE

Micromatic tools are designed for durability, especially at all stress points and joints. Plastic or soft metal holders prolong abrasive life, greatly reduce tool wear.



MAINTAINS ORIGINAL BORE LOCATION

Micromatic either floats the tool or the work holding fixture so tool and work piece can automatically align themselves. This assures cutting-unit rotation coincides with neutral axis of bore.



WRITE FOR LITERATURE

Micromatic produces tools best suited to the production of individual work pieces. And properly integrates the tool with machine and fixturing for peak productivity at lowest cost per piece produced.

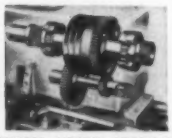
*Registered U.S. Pat. Off.

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

PROOF OF PERFORMANCE
"Clausing 5400-series lathes are dependably accurate — easy to operate — have more stamina than lathes of comparable size. We have 7 and we're sold on them — they're the biggest lathe value we've found."
ALMOR TOOL COMPANY, Detroit, Michigan

"Dependably accurate — have more stamina,
CLAUSING **5400-SERIES** *LATHES*
are the biggest lathe value we've found"

FLAME HARDENED BED WAYS — a long-service-life feature that is standard equipment at no extra cost.



TIMKEN "ZERO-PRECISION" TAPERED ROLLER BEARINGS assure precision performance and long accuracy life.

UNDERNEATH DRIVE with choice of variable speed countershaft or 10-speed countershaft, with clutch and brake optional.

This reaction to Clausing 5400-series 12¾" lathes is typical of user reports. Here are a few reasons why –

"Dependably accurate" – Spindle turns on Timken "Zero-Precision" tapered roller bearings. Bed ways are flame hardened, precision ground. Accuracy is *verified* by test report with each lathe.

"More stamina" – Has massive bed, headstock, apron, tailstock – forged steel spindle – three V-belts driving spindle pulley – heavy-duty variable speed drive or heavy-duty 10-speed countershaft. More *"beef" throughout.*

Get *all* the facts, compare, and you, too, will find Clausing *"the biggest lathe value"! Prices start at only $1075.*

Write for FREE LITERATURE
CLAUSING DIVISION
ATLAS PRESS COMPANY
12-108 N. PITCHER ST., Kalamazoo, Michigan

CLAUSING

JIG BORERS

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

JIG and FIXTURE PARTS

Northwestern Tools, Inc., 117 Hollier Ave., Dayton 3, Ohio.

JIGS AND FIXTURES

Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Columbus Die Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Metal Carbides Corp., Youngstown 12, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

KEYSEATERS

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Bliss, E. W. Co., Canton, Ohio
Mitts & Merrill, 1809 S. Water St., Saginaw, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

KNURLING TOOLS

Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

LAPPING MACHINES

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.

LATHE ATTACHMENTS

Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.

LATHES, AUTOMATIC—See Chucking Machines

LATHES, Axle

Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Il.

LATHES, Bench

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

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LATHES, Car Wheel
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

LATHES, Copying, Duplicating — See Lathes, Duplicating

LATHES, Crankshaft
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Consolidated Mch., Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

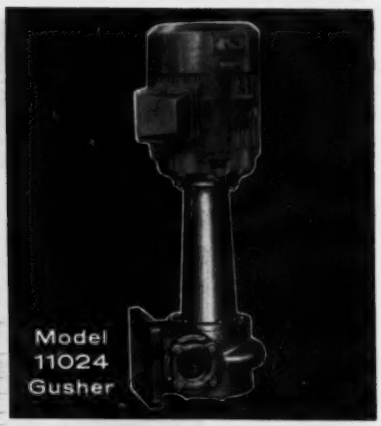
LATHES, Duplicating
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Sidney Machine Tool Co., Sidney, Ohio

LATHES, Engine, Manufacturing
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

LATHES, Engine, Toolroom
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerai Ave., Cincinnati 25, Ohio
Logan Engineering Co., 4901 Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

LATHES, Gap
Atlas Press Co., Kalamazoo, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio

LATHES, Hollow Spindle
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.



NEED A LARGER PUMP?

We can supply you with larger type centrifugal pumps for pumping coolant, some acids, oils. These pumps can—

- Pump up to 400 gallons per minute, maximum.
- Pump up to 90 foot head, maximum.

Sealess and seal type pumps, immersed or flange mounted.

They are also adaptable for high temperatures up to 600° F. equipped with fan, lantern and non-friction grease seal for fumes, etc.

or smaller pumps too...

Don't forget that Ruthman has a complete line of smaller centrifugal pumps from 1/30 horsepower. *Write for our complete catalog.*

Have you a pump problem?

As specialists in the design and manufacture of Centrifugal Pumps, we are ready to help you with any *Centrifugal* pump problems. Just call on us any time.

THE Ruthman MACHINERY CO.

- COOLANT PUMPS
- CIRCULATORS • AGITATORS
- MOLTEN METAL PUMPS

1807 Reading Rd. • Cincinnati, Ohio

MARVEL Synclinal FILTERS

are Standard Equipment

on this
CIANT SKYLIFT Model HR-250
by Automatic Transportation Co. of Chicago.

Capable of lifting a 25,000 pound load. It is especially designed to haul coils in steel mills. Marvel Synclinal Filters are installed as standard equipment.

Photo Courtesy Automatic Transportation Co. of Chicago

OVER 800
Original Equipment Manufacturers
are installing Marvel Synclinal Filters for dependable protection on machinery, mobile or stationary, utilizing hydraulic and other low pressure circulating systems.

SUMP TYPE (Cutaway)

Marvel's *BALANCED* Synclinal Design offers Greater *ACTIVE* Filtering area plus Greater *STORAGE CAPACITY* for filtered out particles—RESULT—*LOWER PRESSURE DROP* over prolonged periods of operation.

A SIZE FOR EVERY NEED
Available for either Sump or Line installation in capacities from 5 to 100 G.P.M. (Greater capacities may be obtained by multiple installation as described in catalog. Choice of mesh sizes range from coarse 30 to fine 200.

EASY TO CLEAN
Both Sump type and Line type are easily disassembled, thoroughly cleaned and reassembled, on the spot in a matter of minutes. Line type may be serviced without disturbing pipe connections.

IMMEDIATE DELIVERY
Catalogs contain complete engineering data and dimensional charts making it easy to order a filter for your specific requirements and get Immediate Delivery.

LINE TYPE (Cutaway)

For further information, write, wire, phone or use coupon below.

MEET J. I. C. STANDARDS

MARVEL ENGINEERING COMPANY
7227 N. HAMLIN AVE.,
CHICAGO 45, ILLINOIS
Phone: JUNIPER 8-6023

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated: (MY-12)
☐ Catalog #108—For Hydraulic Oils, Coolants, Lubricants
☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
☐ Catalog #301—For Water

Name ..... Title .....
Company .....
Address .....
City ..... State .....

LATHES, Roll
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati 2, Ohio
Bliss, E. W., Co., Canton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City, 2, N. J.

LATHES, Speed, Second-operation
Atlas Press Co., Kalamazoo, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Seneca Falls Mch. Co., Seneca Falls N. Y.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic
Atlas Press Co., Kalamazoo, Mich.
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
King Machine Tool Div., American Steel Foundreis, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type Saddle Type
Atlas Press Co., Kalamazoo, Mich.
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mach. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret, Vertical—See Boring Mills, Vertical

LAYOUT and DRAFTING TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett, L. S., Co., Athol, Mass.

LEVELS
Lufkin Rule Co., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.

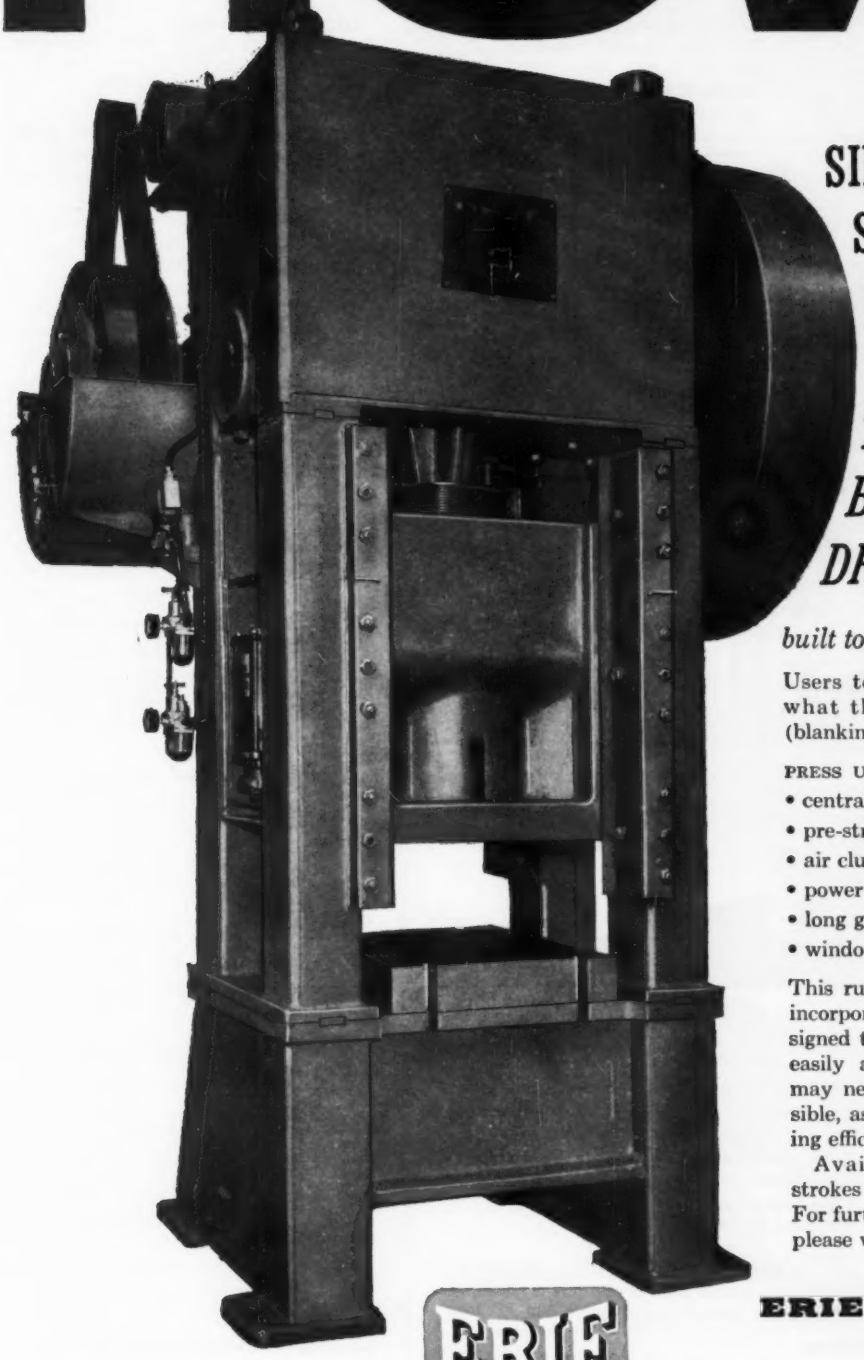
LIMIT SWITCHES—See Switches, Limit

LUBRICATING OILS and GREASES
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Cities Service Oil Co., 70 Pine St., New York, N. Y.

(Continued on page 288)

new

FROM ERIE FOUNDRY CO.



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built to J. I. C. standards

Users told Erie Foundry engineers what they wanted in a trimming (blanking and drawing, too) press.

PRESS USERS ASKED FOR:

- central forced lubrication
- pre-stressed strain rods for rigidity
- air clutch and brake
- power ram adjustment
- long guide faces, easily adjusted
- windows in the side housing

This rugged new Erie Foundry press incorporates all these features so designed that maintenance may be done easily and quickly. All parts which may need servicing are readily accessible, assuring maximum press operating efficiency.

Available in various speeds and strokes in sizes from 150 to 600 tons. For further information, or quotations, please write.

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ERIE 5, PA.

World's greatest name in forging machinery since 1895

For more data, circle page number of this ad on inquiry card

Shell Oil Co., 50 W. 50th St., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS
Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave., Chicago 23, Ill.
Madison-Kipp Corp., Madison, Wis.

MACHINERY, Used and Rebuilt
Eastern Mchry. Co., 1000 Tennessee Ave., Cincinnati, Ohio
Miles Mchry. Co., 2025 E. Genessee Ave., Saginaw, Mich.
Van Keuren Co., Watertown 72, Mass.

MACHINISTS' SMALL TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Starrett, The L. S., Co., Athol, Mass.

MANDRELS—See Arbors and Mandrels

MARKING MACHINES and DEVICES
Gorton Mch. Co., 1321 Racine St., Racine Wis.

MATERIAL-HANDLING TRUCKS—See Trucks, Material Handling

MEASURING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lufkin Rule Co., Saginaw, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., 721 Springfield St., Dayton, 1, Ohio
Van Keuren Co., Watertown 72, Mass.

MEASURING WIRES—Thread, Spline, Gear
Sheffield Corp., Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROMETER HEADS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

MICROMETERS, Outside, Inside, Depth
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROSCOPES, Toolmakers'
Bausch & Lamb Optical Co., Rochester, N. Y.
DoALL Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING MACHINE ATTACHMENTS
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Fred-Tex Machine, Inc., Fredericksburg, Tex.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Automatic
Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Nichols, W. H. Co., Waltham 54, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

MILLING MACHINES, Bed Type, Simplex, Duplex
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cincinnati Milling & Grinding Mches., Inc., 470 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Wrks., Front St., and Girard Ave., Philadelphia, Pa.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Bench, Hand
Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.

New L&J SINGLE CRANK STRAIGHT SIDE PRESS

STANDARD EQUIPMENT
Air clutch and brake. IIC controls plus dual air valve. Four square type gibs with bronze surfaced ways on ram. Hard bronze crankshaft bushings and ball seat. Ram counterbalances. Forced lubrication, etc.

- **150 ton capacity adaptable for a wide range of jobs.**
- **Plain flywheel or back geared type.**
- **6½" dia. main bearings, 9" dia. crank pin.**
- **Dimensions of bed and ram face, stroke length and shut height available as required.**
- **Extra heavy box type steel weldment tie rod construction.**
- **Rigid and accurate for precision work and long die life.**

Write — Bulletin L-18 on 20 to 150 ton single and double crank straight side presses . . . also, 30 to 75 ton double crank gap frame presses.

L&J PRESS CORPORATION 1631 STERLING AVE. ELKHART, IND.

For more data, circle page number of this ad on inquiry card

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Nichols, W. H. Co., Waltham 54, Mass.
Snyder Tool & Engrg. C., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

MILLING MACHINES, Die Sinking, Duplicating, Profiling

Arrow Engineering Co., 120 E. Market St., Indianapolis, Ind.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Consolicated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Geo., Mch., Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

MILLING MACHINES, Knee Type Rise and Fall

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., 42 Exchange Place, Jersey City, N. J.

MILLING MACHINES, Knee Type Ram

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Turret

Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MILLING MACHINES, Knee Type, Vertical

Atlas Press Co., Kalamazoo, Mich.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

MILLING MACHINES, Planer Type

Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R.R., Evanston, Cincinnati, Ohio
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Spar

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MOLDING MACHINES, Plastic

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

MOTORS, Air

Ingersoll-Rand Co., Phillipsburg, N. J.

2548

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this
DIE-PART PORTELVATOR®
(OR AN ENGINEERED VARIANT)
will speed your work
and ease your "handling."
Top plate raises and lowers for fitting operations and rotates 360° to give easy access to die.

Write for our FREE Bulletin No. 2548. It gives full details.

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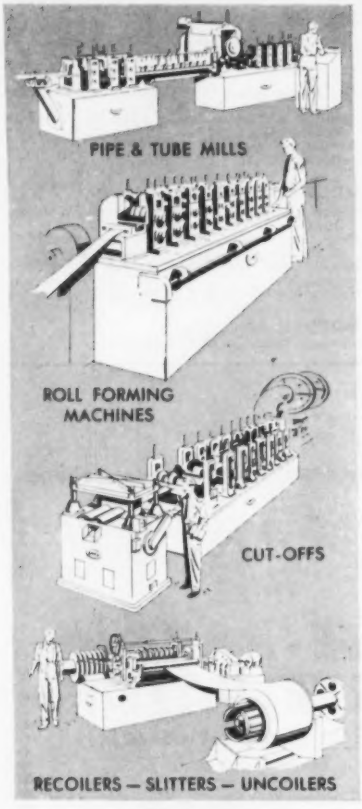
HAMILTON · OHIO · U. S. A.



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Special attachments and auxiliary units can perform additional operations such as welding, coiling, punching or embossing without extra labor cost while increasing production speed.

Let Yoder engineering and "know-how" help you get the most from your plant ... with Yoder equipment. For full details, write to:

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ENGINEERING YODER MANUFACTURING
PIPE AND TUBE MILLS
(ferrous or non-ferrous)

MOTORS, Electric
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Lincoln Electric Co., Cleveland 17, Ohio
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

MOTORS, Hydraulic
Barnes J. S., Corp., Rockford, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

MULTIPLE INSPECTION GAGES—See Gages, Multiple Inspection

MULTIPLE-STATION MACHINES, Dial Type
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
National Automatic Tool Co., S. 7th N. St. Richmond, Ind.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

MULTIPLE-STATION MACHINES, Transfer Type
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sundstrand Mch., Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9399 S. Kenwood Ave., Chicago 19, Ill.

NIBBLING MACHINES
Wales-Strippit Corp., Akron, N. Y.

NUT SETTERS—See Screwdrivers, etc.

NUTS—See Bolts, Nuts and Screws

OIL GROOVERS
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OILERS AND LUBRICATORS
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.
Wicaco Mch. Corp., Philadelphia, Pa.

OILS, CUTTING SOLUBLE—See Cutting and Grinding Fluids

OILS, Lubricating—See Lubricating Oils and Greases

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 - 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.

OPTICAL FLATS
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
DoALL Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Van Keuren Co., Watertown 72, Mass.

PACKING, Leather, Metal, Rubber Asbestos, Etc.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.

PAINTING EQUIPMENT, Spray—See Spraying Equipment, Metal

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Starrett, The L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

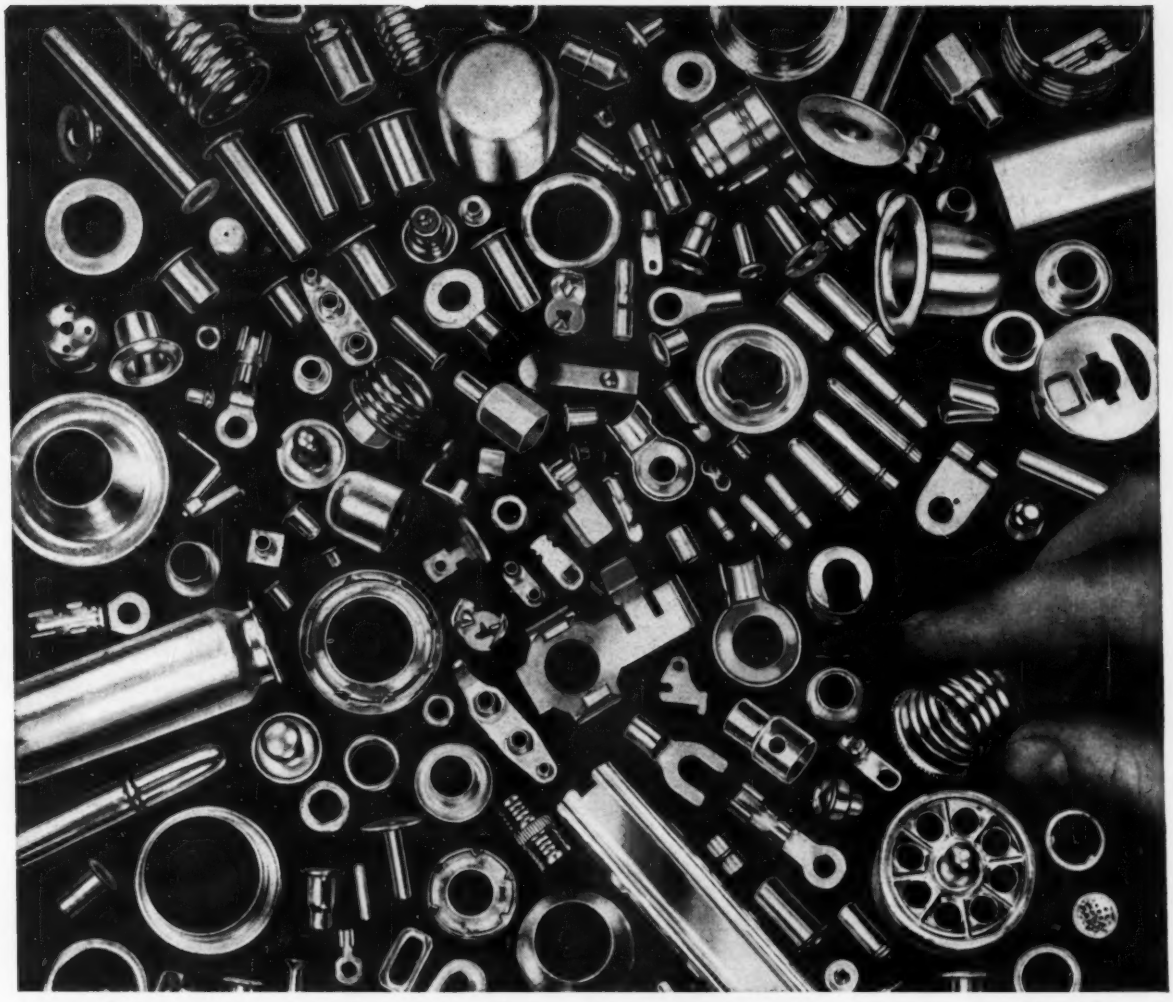
PIPE, Steel, Stainless, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE AND TUBING MILLS, Electric-weld
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

PIPE AND TUBING, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.

PIPE THREADING AND CUTTING MACHINES
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Landis Machine Co., Inc., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

For more data, circle page number of this ad on inquiry card



All of these parts were designed to serve a specific function—at a lower cost. Some are made by customer-owned tools.

Pick a part! any part . . . any metal

Then ask us for an eye-opening quotation

These are only a few of the thousands of multiple-plunger and progressive-tool press products we supply to every branch of industry—from simple eyelets to precision electronic components.

We offer a complete design-engineering service based on long experience and specialized production equipment, and are often able to suggest ways and means of using our stock tools to further cut costs.

Simply send us a sample, drawing or description of the parts you need, plus the quantity. The metal can be copper, brass, bronze, nickel silver, nickel, iron, steel, stainless steel or aluminum . . . and in any applied or plated finish you choose.

Send your inquiry to: The American Brass Company, Fabricated Metal Goods Division, Waterbury 20-A, Connecticut.

5852 Rev.

NEW CATALOG: Send for Publication BG-5, "Anaconda Fabricated Metal Products." It suggests design possibilities and production economies available with multiple-plunger and progressive-tool press products. Information on deep drawn and stamped parts is also included.

ANACONDA®

Multiple-Plunger Press Products

For more data, circle page number of this ad on inquiry card

PLANER JACKS—See Set-up Equipment

PLANERS, Double Housing and Openside

Consolidated Mch. Tool Div., Rochester, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A. Co., 3611 Woodburn Ave., Cincinnati, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLASTICS AND PLASTIC PRODUCTS

Eastman Kodak Co., 343 State St., Rochester 4, N. Y.
Gisholt Mch. Co., Madison, Wis.
U. S. Steel Corp., Nat'l Tube Div., Pittsburgh, Pa.

PRESS BRAKES—See Brakes, Press and Bending

PRESS FEEDER, Automatic

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., 255 N. 18th St., Ampere, East Orange, N. J.

PRESSES, Arbor

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Famco Machine Co., Kenosha, Wis.
Logansport Machine Co., Inc., Logansport, Ind.
Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.

PRESSES, Assembling

Alva Allen Industries, Clinton, Missouri
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Dake Corp., 604 Monroe Ct., Grand Haven, Mich.
Denison Enginering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

PRESSES, Blanking, Stamping

Alva Allen Industries, Clinton, Missouri
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E. Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 N. 8th St., Ampere, East Orange, N. J.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Briquetting

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Denison Engineering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

PRESSES, Closed-Die Forging

Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland 17, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Coining, Embossing

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Die Sinking (Hobbing)

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Die Tryout

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Drawing

Alva Allen Industries, Clinton, Missouri
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Cincinnati Milling & Grinding Machines, Inc., 4710 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6399 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Extrusion

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Foot

Famco Machine Co., Kenosha, Wis.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Horning

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

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Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit Corp., Akron, N. Y.

PRESSES, Punching, Piercing

Alva Allen Industries, Clinton, Missouri
Batemen Fdry. & Mche., Mineral Wells, Tex.
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Famco Machine Co., Kenosha, Wis.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit Co., Akron, N. Y.
Wiedemann Machine Co., Gulph Rd., King of Prussia, Penna.

PRESSES, Quenching

Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Gleason Wks., 1000 University Ave., Rochester 3, N. Y.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

PRESSES, Rubber-Forming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PRESSES, Trimming

Alva Allen Industries, Clinton, Missouri
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PROFILING MACHINES—See Milling Machines, Die Sinking, etc.

PROTECTORS, Thread & Tube

Maybrun, A. E. Co., 920 Ripey St., Santa Rosa, Calif.

PULLEYS

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

PUMPS, Coolant and Lubricant

Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Graymills Co., 3705 N. Lincoln Ave., Evanston, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Little Giant Pump Co., 5101 Classen Blvd., Oklahoma City 18, Oklahoma
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 2, Ohio
Viking Pump Co., Cedar Falls, Iowa

PUMPS, Hydraulic

American Engineering Co., Wheatsheaf Lane & Sepviva St., Philadelphia 37, Penna.
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa

PUNCHES AND DIES—See Dies, Blanking, etc.

REAMERS, Rose, Chucking, Jobbers Taper, Shell, Adjustable, etc.

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

REELS, Stock

National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

REFRACTORS Heat-Treating Furnaces

Norton Co., 1 New Bond St., Worcester 6, Mass.

RETAINING RINGS FOR BEARINGS, etc.

Bearings, Inc., 3634 Euclid Ave., Cleveland, Ohio

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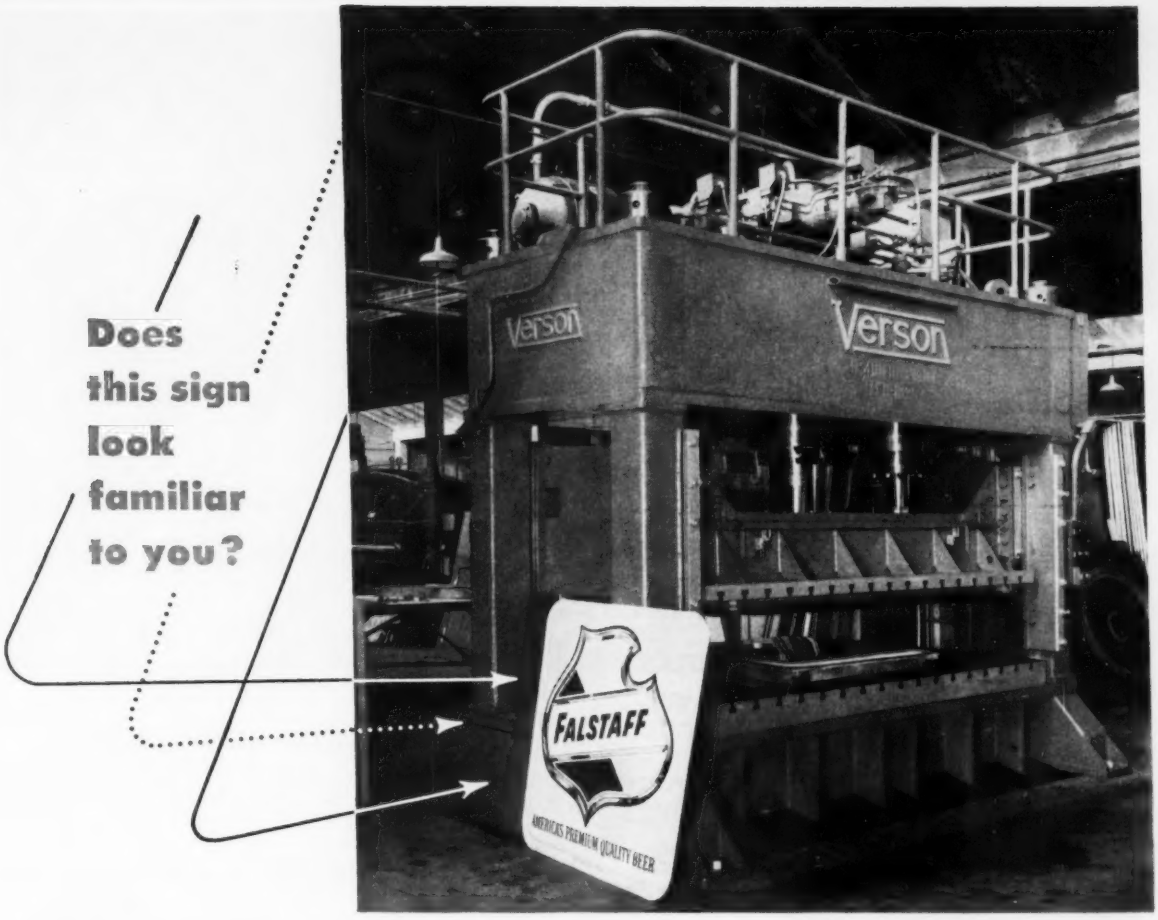

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RIVETERS, Portable
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

RIVETERS, Stationary
Brown & Sharpe Mfg. Co., 35 Promenade St., Providence 1, R. I.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

ROTARY TABLES, Optical
Machine Products Corp., 6771 E. McNichols Rd., Detroit 12, Michigan

RULES, SCALES AND STRAIGHTEDGES
See Machinists' Small Tools

RUST INHIBITORS
Kasenit Co., Mahwah, N. J.
Oakite Products, Inc., 26 Rector St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.

SAND BLAST EQUIPMENT—See Blast Cleaning Equipment

SAW BLADES, Hack, Band, Circular Friction
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Capewell Mfg. Co., 60 Governor St., Hartford, Conn.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
DoALL Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Mach. Works, Philadelphia, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

SAW BLADE SHARPENERS
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoALL Co., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.

SAWING MACHINES, Abrasive Machines—See Cutting-off Saws, Abrasive Wheel

SAWING MACHINES, Band
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Cutron Mfg. Co., Lubbock, Texas
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoALL Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., Kenosha, Wis.

SAWING MACHINES, Circular Blade
Consolidated Mch. Tool Div., Blossom Road Rochester 10, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoALL Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ty-So-Man Machine Co., Inc., Knoxville, Tenn.

SAWING MACHINES, Power Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

SAWS, Screw-slotting—See Cutters, Milling

SCREW DRIVERS, STUD AND NUT SETTERS, Power
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Air Tools, P. O. Box 2119, Houston, Texas
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.

SCREW MACHINES, Hand—See Lathes, Turret, Ram-type, Saddle-type

SCREW MACHINES, Single-Spindle Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

SCREW MACHINES, Multiple-Spindle Automatic
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
National Acme Co., 170 E. 31st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey, 6701 Carnegie Ave., Cleveland 3, Ohio

SCREW PLATES
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

SCREWS, Cap, Set, Self-tapping, etc.—See Bolts, Nuts and Screws

SEALS AND RETAINERS—Oil or Grease
Bearings, Inc., 3634 Euclid Ave., Cleveland, Ohio
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Gits Bros. Mfg. Co., 1858 S. Kibourn Ave., Chicago, Illinois

SEPARATORS, Magnetic
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

SET-UP EQUIPMENT
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Lufkin Rule Co., Saginaw, Mich.
Northwestern Tools, Inc., 117 Hollier Ave., Dayton 3, Ohio
Starrett, The L. S., Co., Athol, Mass.

SHAPERS, Crank and Hydraulic
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

SHAPERS, Vertical and Slotters
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHEARS, Alligator
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

SHEARS, Guillotine Bar
Beatty Machine & Mfg. Co., Hammond, Ind.

SHEARS, Rotary
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.

SHEARS, Squaring
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Famco Machine Co., Kenosha, Wis.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS—See Strip and Sheet, Ferrous, Non-ferrous

SHIM STOCK
Laminated Shim Co., Inc., Glenbrook, Conn.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

SLITTING MACHINES, Rotary
Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

SLOTTERS—See Shapers, Vertical and Slotters

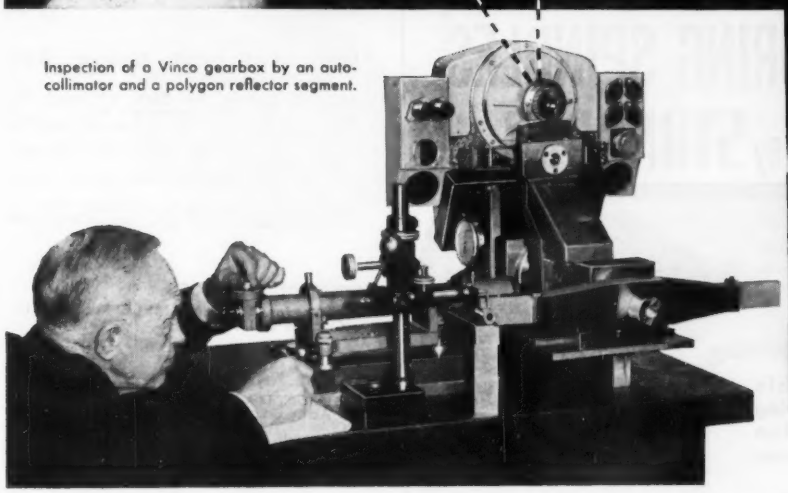
SOCKETS—See Drill Sleeves and Extension Holders

SOLENOIDS
Allen-Bradley Co., 1331 S. 1st St., Milwaukee 4, Wis.
Barnes, John S. Corp., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Vickers, Inc., Detroit 32, Mich.

SPECIAL MACHINERY AND TOOLS
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

MISSILES GEARED TO A STAR BY VINCO

Accuracy of 3.6 seconds of arc.
Gear ratio 2,584,800 – 1.



Inspection of a Vinco gearbox by an autocollimator and a polygon reflector segment.

Test stands for missile guidance systems include a gearbox built by Vinco to isolate the gyro system from the earth's rotation. Driven by an 1800 RPM synchronous motor, with a gear head stepdown to 1RPM, it produces an output motion of one turn in one sidereal day. Output accuracy limit of 3.6 seconds of arc reflects the action of 8 Vinco gears and 9 precision ball bearings. It is equivalent to .00018″ error of motion at the pitch line of a 32 diametral pitch, 20° pressure angle, 20.625 pitch diameter output sector.

Such accuracy is a must for checking the error or drift of gyroscopic and inertial guidance equipment. The gears in the sidereal rate test gearbox were ground and inspected on Vinco equipment by Vinco craftsmen. This personnel and equipment are available for producing gears of the same high precision for you.

The Vinco Optical Master Inspection Dividing Head is the most accurate instrument of its kind for checking angular spacing. Accuracy is guaranteed within a total variation of 2 seconds of arc (± 1 second). This instrument is available in both standard and heavy duty models.

VINCO CORP., 9111 Schaefer Hwy., Detroit 28, Mich.

For more data, circle page number of this ad on inquiry card

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

No. 4003B with Mounting Bracket
No. 4203B with Removable Boring Head
SUPER PRECISION
BORING SPINDLES
By STANDARD
No. 4407B Piggy-Back Assembly
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Specify rugged, dependable Standard Super Precision Boring Spindles. The nation's widest line of conventional designs plus custom engineering service.
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PRECISION SPINDLE DIVISION
the STANDARD electrical tool co.
2500 RIVER ROAD, CINCINNATI 4, OHIO
Since 1912
HALLMARK OF METALWORKING THROUGHOUT THE WORLD

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Barnes, John S. Corp., Rockford, Ill.
Boston Gear Works, 320 Main St., North Quincy 71, Mass.
DoALL Co., Des Plaines, Ill.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

SPINDLES, Machine
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio.

SPRAYING EQUIPMENT, Metal
Metallizing Eng. Co., Westbury, L. I., N. Y.

SPROCKETS—See Gears, Cut

STAMPINGS, Sheet Metal
Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STEEL ALLOYS—See Alloy Steels

STEEL, Cold Rolled, Stainless, High-speed, Tool, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL DISTRIBUTORS
Ryerson, Jos. T., & Son, 16th & Rockwell Sts., Chicago 8, Ill.

STOCKS AND DIES
DoALL Co., Des Plaines, Ill.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Threadwell Tap & Die Co., Greenfield, Mass.

STRAIGHTEDGES—See Machinists' Small Tools

STRAIGHTENERS, Flat Stock and Wire
Bliss Co., E. W., Canton, Ohio.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

STRIP AND SHEET, Ferrous
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

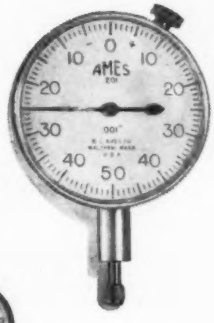
STRIP AND SHEET, Non-ferrous
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

For more data, circle page number of this ad on inquiry card

PORTA-CHECK®
A transistorized portable comparator for fast accurate measurement in both "tenths" and "thousandths" scales.

MODEL AG AIR GAUGE
For checking diameters, dimensions, roundness, etc.

200 SERIES MICROMETER DIAL INDICATOR
One of four sizes. Made to AGD specifications.



NO. 2 DIAL COMPARATOR
For desk, bench or at-the-machine inspection of small parts.

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Masters of Measurement...

For more than half a century, Ames measuring instruments have been regarded as the finest made. Today the constantly growing line of Ames indicators, gauges, micrometers and comparators includes such amazingly accurate instruments as the new Ames "PORTA-CHECK", an electronic comparator which gives accurate readings *in millionths of an inch*; and the new Model AG air gauge—also accurate to millionths of an inch. Wherever precision is *really* important . . . you'll find Ames "masters of measurement" on the job.

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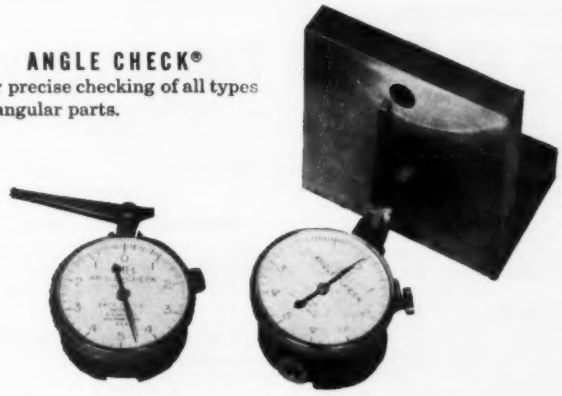
MANUFACTURERS OF MICROMETER DIAL INDICATORS AND GAUGES

ANGLE CHECK®
For precise checking of all types of angular parts.



STRUCTURAL SHAPES
Bethlehem Steel Co., Bethlehem, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STUD SETTERS—See Screwdrivers, etc.

SUPERFINISHING EQUIPMENT
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh, Pa.
DoALL Co., Des Plaines, Ill.

SWITCHES, Limit
Allen-Bradley Co., 1331 So. 1st St., Milwaukee, Wis.

TACHOMETERS—See Indicators, Speed

TAP HOLDERS
Brown & Sharpe Mfg. Co., 235 Promendae St., Providence 1, R. I.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.

TAPPING HEADS
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
National Automatic Tool Co., S. 7th & N. Sts., Richmond, Ind.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

TAPPING MACHINES
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Baush Machine Tool Co., 15 Wason Ave., Springfield 7, Mass.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.
Cincinnati Bickford Div. of Giddings & Lewis Mch. Tool Co., Oakley, Cincinnati 9, Ohio.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Edlund Machinery Co., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Kaufman Manufacturing Co., Manitowac, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Landis Mch. Co., Waynesboro, Pa.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

TAPS, Hand, Machine Screw, Pipe, etc.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.

TESTING EQUIPMENT, Air, Oil & Water Pressure
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

THREAD CUTTING MACHINES
Davis & Thompson Co., 4460 W. 124th St., Milwaukee 10, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio.

THREAD CUTTING TOOLS
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Geometric Tool Co. Div., Greenfield Tap & Die Corp., New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio.

THREAD ROLLING DIES—See Dies, Thread Rolling

THREAD ROLLING EQUIPMENT
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio.
National Machinery Co., Tiffin, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.
V & O Press Co., Hudson, New York

TIME RECORDERS
Lathem Time Recorder Co., Atlanta 8, Georgia

TOOL CONTROL BOARDS
Cross Co., 3250 Bellevue, Detroit, Mich.

TOOL HOLDERS
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, Cast Non-Ferrous Alloy
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, Cemented Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Metal Carbides Corp., Youngstown 12, Ohio.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, Ceramic
Metal Carbides Corp., Youngstown 12, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, High-Speed Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.

TRACING ATTACHMENTS
American Tool Works Co., Pearl & Eggleston Aves., Cincinnati 2, Ohio.
Atlas Press Co., Kalamazoo, Mich.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Wales-Strippit Co., Akron, N. Y.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

TRANSFER MACHINES, Automatic—See Multiple-Station Machines

TRANSMISSION, Variable Speed
Barnes, John S. Corp., Rockford, Ill.
Boston Gear Wks., Quincy, Mass.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio.
Vickers, Inc., Detroit 32, Mich.

TRUCKS, Material Handling
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio.

TUBE-FLANGING MACHINES
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.

TUBE FORMING AND WELDING MACHINES
Yoder Co., 5504 Walworth Ave., Cleveland, Ohio.

TUBE MILLS
Yoder Co., 5504 Walworth Ave., Cleveland, Ohio.

TUBING, Non-ferrous
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 34, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.

TUBING, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
National Tube Div., U. S. Steel Corp, 525 Wm. Penn Place, Pittsburgh, Pa.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.
Timkin Roller Bearing Co., Canton, Ohio.

TUBE & PIPE CUTTING-OFF MACHINES
Grieder Industries, Inc., Bowling Green, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.

ULTRASONIC MCH. TOOLS
Sheffield Corp., Box 893, Dayton 1, Ohio.

VALVE CONTROLS
Barnes, John S. Corp., Rockford, Ill.
Logansport Mch. Co., Inc., Logansport, Ind.
Vickers, Inc., Detroit 32, Mich.

VALVES, Air
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Numatics, Inc., Milford, Mich.
Ross Operating Valve Co., 110 E. Golden Gate Ave., Detroit 3, Mich.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

VALVES, Hydraulic
Barnes, John S. Corp., Rockford, Ill.
Denison Engineering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Hydraulic Press Mfg. Div., Mount Gilead, Ohio.

(Continued on Page 302)

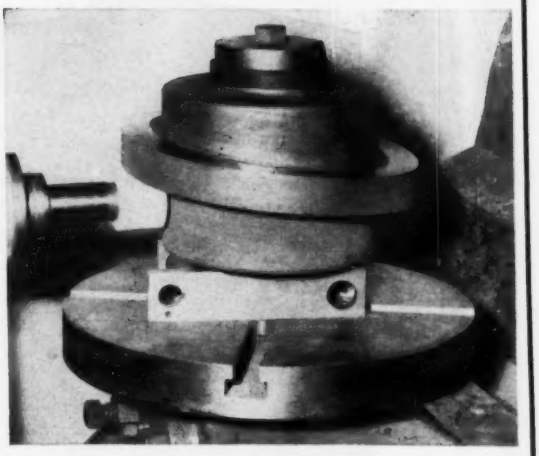
Rowbottom for Cams

You can't buy this experience BUT it's yours when you need it

Rowbottom engineers . . . backed by complete modern cam-making facilities . . . are at your service to help you in cam design and production. Any type cam you need . . . barrel, box, side or indexing . . . in any quantity and in practically any size . . . can be produced by Rowbottom exactly to your specifications, with precision, speed and at worthwhile savings.

Back of this complete service is Rowbottom's long, exclusive experience in cam manufacture . . . an experience which is your assurance of expert technical advice and intelligent handling of your requirements whether it means producing the cams you need or furnishing the machines to make them. You incur no obligation in asking for assistance on your requirements. Send for illustrated literature . . . consult Rowbottom . . . NOW!!

Rowbottom service includes acting as your "Cam Production Department" or in equipping your production line with Cam Millers, Cam Grinders and Rotary Profilers to meet your needs. Also contract rotary profiling.



"Male" Barrel Cam produced by Rowbottom. The cam fits between two rolls on a fixed center distance. This cam typifies "end results" of Rowbottom experience.

The ROWBOTTOM MACHINE CO.

WATERBURY, CONN.

For more data circle Item 701 on Inquiry Card

BOSS . . . you haven't walked me around the block for weeks, and you know what weak kidneys I have. Why don't you see your Threadwell Distributor for high performance cutting tools. You'll get home from the shop a lot quicker, and I won't have to lead such a man's life. *Photo by Cobb Shinn for Threadwell Tap & Die Co., Greenfield, Mass.*

For more data circle Item 702 on Inquiry Card

DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2303R North 11th St. • St. Louis 6, Mo.

CUT SCRAPER TIME

END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2303R NORTH 11TH ST., ST. LOUIS 6, MO.

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None Better than these Lowest Priced POLYETHYLENE THREAD and TUBE PROTECTORS

MITEY-TITES
seal out moisture and dirt—
protect end fittings
through handling and shipping

For prices and complete list of sizes, write to
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For over 40 years MACHINERY'S HANDBOOK has been the indispensable working reference book for designers, engineers, production executives, machinists, inspectors, students, apprentices—providing men in every phase of metalworking with the kind of information they need daily in their work.

And this information is constantly kept up to date. For example, in preparing the new 15th Edition, 432 pages of the 14th Edition were revised to include the latest and most authoritative information. Because MACHINERY'S HANDBOOK is the largest selling handbook in the field, editions are more frequent. You benefit by receiving the latest information—sooner!

Furthermore, volume sales help us keep costs down . . . and we pass these savings on to you! MACHINERY'S HANDBOOK is $9.00—the biggest $9.00-worth in the field—an investment that will repay its cost many times over in the wealth of practical, accurate information it puts at your command. Order your copy today by mailing the convenient coupon below.

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☐ **Bill me.** ☐ **Bill Company.**

($9.00 in U.S. $10.95 in Canada or overseas)

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Firm Address .....

City ..... **Zone** ..... **State** .....

Home Address .....

(fill in if you want book sent home) **M/12/58**

Logansport Machine, Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

VERNIERS—See Calipers, Vernier; Gages, Vernier

VISES, Machine

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Modern Mch. Tool Co., 2005 Losey Ave., Jackson, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.

WELDING EQUIPMENT, Arc

Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.
Linde Co., 30 E. 42nd St., New York 17, N. Y.

WELDING EQUIPMENT, Gas

Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Linde Co., 30 E. 42nd St., New York 17, N. Y.

WELDING EQUIPMENT, Resistance

Eisler Engrg. Co. Inc., 750 South 13th St., Newark, N. J.
Federal Mch. & Welder Co., Warren, Ohio.

WELDING POSITIONERS

Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.

WELDMENTS

Bliss, E. W. Co., Canton, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

WIPERS

Scott Paper Co., Chester, Pa.

WIRE

Allegheny Ludium Steel Corp., Pittsburgh, Pa. (Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
U. S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh 30, Penna.

WIRE FORMING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

WOODWORKING MACHINES

Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio.
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.

WRENCHES, Allen, End, Socket, Adjustable, etc.

Allen Mfg. Co., Bloomfield, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

WRENCHES, Power Chuck

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.

A Grieder Tube Cut-Off Machine will produce 4500 to 6500 cut-offs per hour

Grieder Tube Cut-Off Machines are 3 to 8 times faster than others, and speed is only one of the cost saving advantages they provide. For example:

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- $ Precision clamping dies prevent tube distortion and produce a quality cut. Tube does not rotate.
- $ Thousands of cuts without grinding. Blades can be sharpened on standard tool room equipment and used for as many as a million cuts.

Write for literature, stating tube sizes and production requirements.

Grieder

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COMPANY_____

CITY_____ ZONE____

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For more data circle Item 705 on Inquiry Card

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BEVELS TO 54" PD. 1 DP
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CONTINUOUS-TOOTH HERRINGBONE TO 60" PD. 2 DP
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SILENT GEARS. RAWHIDE. BAKELITE. FIBROIL
HEAT-TREATED CASE OR FLAME HARDENED GEARS—OF CARBON OR ALLOY STEEL

Stahl
GEAR & MACHINE COMPANY
3901 HAMILTON AVENUE
CLEVELAND 14, OHIO

For more data circle Item 706 on Inquiry Card

DAD? You said you were coming home early. All the other kids' fathers are home. Why don't you use Threadwell cutting tools like they do? That's what Mommy told me to say. Grandpa is a Threadwell Distributor, you know. *Photo by Cobb Shinn for Threadwell Tap & Die Co., Greenfield, Mass.*

For more data circle Item 707 on Inquiry Card

Lepel

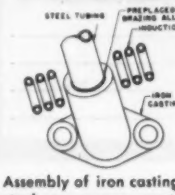
HIGH FREQUENCY INDUCTION HEATING UNITS

The Lepel line of induction heating equipment represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating.

If you are interested in induction heating you are invited to send samples of the work with specifications. Our engineers will process and return the completed job with full data and recommendations without any cost or obligations.

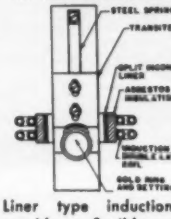
TYPICAL INDUCTION HEATING APPLICATIONS

IRON CASTINGS BRAZED TO STEEL TUBES



Assembly of iron castings and steel or copper parts are facilitated by induction heating. Arrangement is illustrated for silver brazing malleable iron castings to steel tubing. Coil design shown provides uniform heating for joint. Proper joint design assures high bond strength. Electrolytic treatment of castings to remove carbon (Kolene Treatment) increases strength and tightness of joint to gases and liquids.

GOLD BRAZING IN JEWELRY INDUSTRY



Liner type induction coil provides a flexible arrangement for brazing settings to gold rings. The simple fixture facilitates handling. The unique coil design permits heating by induction and by radiation from heated metal liner. Ring, setting and gold brazing alloy are pre-assembled in a ceramic jig and then moved into heating position within the coil for brazing.

CUTTER BLADES SELECTIVELY HARDENED

Photo shows coil design and arrangement used to selectively harden edges of cutter blades used in agricultural equipment. In production, cutter blades are automatically fed between layers of the induction coil, selectively heated and then oil quenched at the rate of one per second. Hardness at the cutting edge is Rc 62/64. Distortion is negligible.

Electronic Tube Generators from 1 kw to 100 kw.
Spark Gap Converters from 2 kw to 30 kw.

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For more data circle Item 711 on Inquiry Card

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For more data circle Item 712 on Inquiry Card

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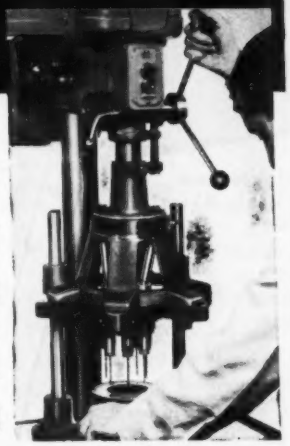
fully adjustable for dependable multi-hole drilling and tapping

5 models to choose from — circle or straight line types



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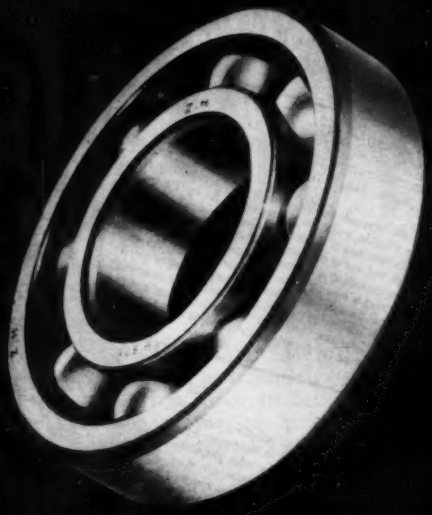
For more data circle Item 713 on Inquiry Card



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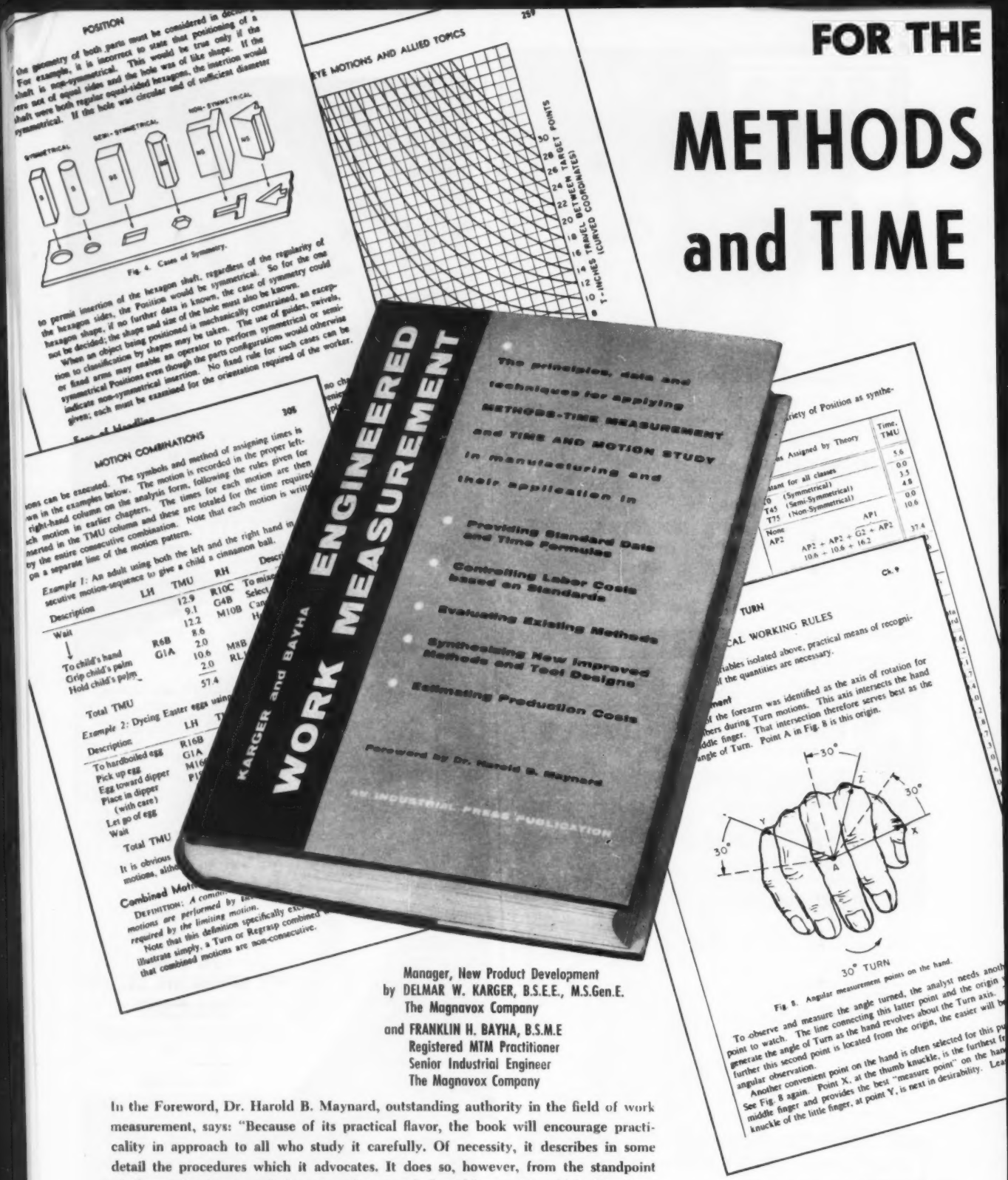
For more data circle Item 714 on Inquiry Card

FOR THE METHODS and TIME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Controlling Labor Costs based on Standards
Evaluating Existing Methods
Synthesizing New Improved Methods and Tool Designs
Estimating Production Costs
Foreword by Dr. Harold B. Maynard
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12x33", 20"x25" Jones & Lamson Fay Automatic Lathes, 1944
No. 3 Lodge & Shapley Duomatic, m.d., late type
No. 3A Lodge & Shipley Duomatic, m.d.
No. 4 B.K. LeBlond Boring Lathe, 37" bed, 4" hole, m.d., latest
No. 9, 12 LeBlond Multi-Cut, m.d.
No. 16 LeBlond Automatic, m.d.
4x60" LoSwing, m.d.
11x18" LeBlond Rapid Production, m.d.
12x18" centers Monarch Model 5T, m.d.
12x18" Reid Small Piece Production, Model 6WSL, m.d.
Model U, 14"x24" centers, LoSwing, m.d.
No. 12 Gisholt Semi-Special Automatic Production, m.d.
No. 9WSL, Reid Production, m.d.
17"x75⅝" LeBlond, m.d.
No. 10 Sundstrand Automatic Production, m.d.
No. 12 Sundstrand Automatic Production, m.d.
14"x21' centers Model L8 Semi-Automatic LoSwing, m.d.
Lips Semi-Automatic Carbo Lathe, m.d.
13"x12¼" centers LeBlond H.D. Rapid Production, m.d.
Model B1 Blount Speed Lathe
Colburn Mfg. Bench Type Speed Lathe, m.d.
Model NA2B Schauer Speed Lathe
Cir-Dan, Type B, Semi-Automatic H.S., single point threading machine, new
10x20" centers Hi-Turn, new

INTERNAL GRINDERS

Type IG 103 Grenby, m.d.
No. 5 Bryant, m.d., latest
Model 5Y Bryant, m.d.
No. 16-16" Bryant, m.d., hydraulic hole grinder
No. 16CR16 Bryant, m.d., latest
No. 16-22" Bryant, m.d., latest
No. 16-38" Bryant, m.d., latest
No. 16-A-28" Bryant, m.d.
No. 24-36" Bryant Hole & Face Type, m.d., late
No. 24-21" Bryant, m.d.
No. 24-P-26" Bryant, m.d.
No. 24-L-36" Bryant, m.d., late
No. 24-LW-36 Bryant, m.d., late
No. 640-16" Van Norman Automatic Oscillating Radius, m.d., latest
No. 70A Heald, m.d., latest, 1945
No. 72A Heald Gagematic, m.d.
No. 72A3 Heald Full Universal, m.d.
No. 72A3 Heald Gagematic, m.d.
No. 72A3 Heald Sizematic, m.d.
No. 72A3 Heald Plain, m.d.
No. 72A5 Heald Plain, m.d.
No. 73 Heald Airplane, m.d., latest, new
No. 74 Heald Long Base, 1945
No. 74 Heald Extended Bridge Type, m.d.
No. 74 Heald, Plain Long Base, m.d., 1943
No. 74 Heald, m.d.
No. 75A Heald, m.d., latest
No. 81 Heald Gagematic, Sizematic, m.d.
No. 81 Heald Plain & Sizematic, m.d.
No. 104 Rivett, m.d.
No. 172 Heald Plain Adjustable Gap Hydraulic, m.d.
Model 2TR Springfield Crown Type Vertical Universal, m.d.

PLAIN CYLINDRICAL GRINDERS

No. 5 Brown & Sharpe Plain Cylindrical, m.d., 1942
No. 20—1018" cap. Brown & Sharpe Plain Cylindrical, m.d.
4-12" Landis Type H Knee Hole Type, m.d.
6x15" Cincinnati Plain Hydraulic, m.d.
6x18" Cincinnati Model EA, m.d.
6x18" Landis Type C Hydraulic, m.d., late
6x18" Norton Plain Grinder, m.d.
10x18" Cincinnati Plain Hydraulic, Model ER, m.d., Filmatic Spindle, 1943
10x18" Cincinnati Model EA, m.d.
10x18" Norton Type C, m.d., latest
10x36" Cincinnati Hydraulic, m.d.
10x36" Norton Type C, m.d.
10x36" Landis Type CH Plain, m.d.
10x48" Cincinnati Model ER Plain Hydraulic, m.d.
12x36" Landis Plain Self-Contained, m.d.
14x36" Landis Type C, 1945
16x72" centers Type C Norton Semi-Automatic, hydraulic
16x96" Cincinnati Plain Cylindrical, m.d.
16x40"x120" Cincinnati Plain Heavy Duty, 1953
16x120" Landis Type B Plain H.D., Hydraulic, m.d., late
18x36" Landis Type C, m.d.
18x72" Norton Type C, mechanical, m.d.
25x72" Landis Type C, m.d.

SNAG GRINDERS

7½ H.P. United States Elec. Tool Co. Double End, Model 80, new
Type No. 50—7½ H.P. Standard Elec. Tool Co. Double End, m.d.
25 H.P. U.S. Elec. Co., Heavy Duty Double End, m.d.

THREAD GRINDERS

No. 33 Excello Precision, m.d.

TOOL & CUTTER GRINDERS

Model 91A Covel Plain, m.d.
Pratt & Whitney Deep Hole Drill Sharpener, m.d.
No. 1 Heald Tool Sharpener, m.d.
No. 2A Wm. Sellers Universal Tool Grinder, m.d.
No. 2B Sellers Wet Drill Grinder, m.d.
No. 4T Sellers Tool, m.d., latest
No. 5T Sellers, m.d.
No. 6G Sellers, m.d.
12" Gleason Spiral Bevel, Gear Cutter Sharpener, m.d.
No. 13 Gleason Cutter Sharpener, m.d., late
Ingersoll Face Mill Grinder
No. 13 Brown & Sharpe Universal, m.d.
No. 4-4 Barber-Colman Hob Sharpener, m.d.
Sundstrand Tool Grinder, m.d.
No. 51 Oliver Drill Pointer, m.d.
12x28" Landis Universal & Tool Grinder, m.d.

UNIVERSAL GRINDERS

14" x 36" Landis Type C, m.d.
14" x 48" Landis Type C, m.d.
14" x 72" Norton Universal Hydraulic, m.d.

HONE MACHINES

No. 3 Barnes Single Spindle Internal Hone, new
No. 182 Bornesdrill, m.d.
No. 854 Micromatic Vertical Honing Machine, m.d.
H1 Micromatic Horizontal Hydrohoner, m.d.
H4 Micromatic Horizontal Hydrohoner, m.d.
No. 6 Barnes Twin Spindle
No. 306H Barnes Twin Spindle
No. 224B Barnes Honing Machine, m.d.
Model 4014C Barnes Self-Oiling Hydraulic vertical
Model MA Sunnen Bench Type, m.d.

KEYSEATERS

Morton, m.d., thru reversing gear box
Taylor & Fenn Horizontal Shaving, Shaping Keyseating, m.d., 1942
W-L-W Machine Keyseater, new

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BALANCER. No. Model 2EQ Tinius Olsen, 1948
BORER. No. 1212 Excello dbl. end
BORING MILL. 3¾" bar No. 5 Defiance, 1942
BORING MILL. 4" Universal Tri-Way 1000 RPM
BORING MILL. 60" Gisholt vert., PRT
CENTERING MACHINES. Nos. 53 & 56 Sundstrand up to 72"
CUTOFF ¼"-3" No. 3A Modern auto. 1950
DRILL No. 20 HO Baker hydr. late
GRINDERS, C'LESS. No. 12 Landis, 1947
GRINDER, CYL. 4" x 12" No. H. Landis, 1943
GRINDERS, UNIV. 14" x 14" Mod. 112 Rivett
GRINDERS, CYL. 20" x 72" Landis, 1943
GRINDER, INT. 72A5 Heald, Univ., Hydr.
GRINDER, INT. No. 74 Heald Hydr., 1941
GRINDER, SURF 8" x 24" DoAll hydr. 1948
GRINDER, SURF. 20" x 24" No. 25A Heald
GRINDER, SURF. 36" Nos. 18 & 16 Blanchard, 1940
GRINDER, CUTTER. 30" Ingersoll, 1942
GRINDER. CARBIDE. Nos. 48 and 49 Excello
GRINDER, RADIUS. No. 49 VanNorman, late
GRINDER, TOOL & CUTTER. No. 2 Cincinnati
HOB SHARPENER. Type HRS Barber Colman
KELLER. BL2416 Pratt & Whitney 3 Spdl., 1941
LATHES, ENGINE. 13", 15" & 17" LeBlond
MILLER, AUTO 36" No. 33 Sundstrand
MILLER HAND. No. 2RV Kent-Owens, 1942
MILLERS. No. 10 & 3 VanNorman Duplex
MILLER, PLAIN. No. 2 Cincinnati
MILLER, PLAIN. No. 3A K & T MSDT 1943
MILLER, VERTICAL. No. 2 Brown & Sharpe
MILLER. No. 36 VanNorman, ram type, 1942
ROUTERS. Type A-1R Onsrud Radial 84", late
SAW. 6" x 6" No. 6 Marvel Hack, late
SAW. 10" x 10" Racine Hydr. Hack, 1941
SHAPER. 6" P&W vert., also 12"
TAPPER No. 10 Warner & Swasey, 1948

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No. 56-90 Cincinnati Duplex Hydro Mill, 1942.
No. 4, 1A Warner & Swasey Preselector Turret Lathes Bar Feed, Chucking, 1947
3' x 11" 3' x 13" Cincinnati Bickford Super Service Radial Drill.
No. 3 CINCINNATI H.S. D.T. Horiz. Mill, NEW 1945. Extra table travel, vert. heads.

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- low cost operation-uses standard tool bits
- heavy-duty hydraulic circuit—assures accurate keyways
- compact, 21" x 61"—no special foundation

Send for Bulletin 34

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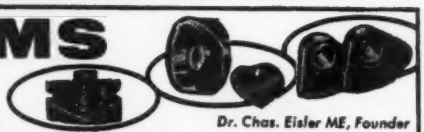

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Chas. Eisler, Jr., Pres.

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GEARS —ALL MAKES . . . Special and standard
PRECISION GEARS UP TO 200 DIAMETRAL PITCH
All Gears certified for Accuracy
Quality and Fine Workmanship
NEW JERSEY GEAR & MFG. CO.
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ONLY

THRIFTMASTER *Universal Joint Type* **DRILL HEADS**

have these exclusive* features

6 Standard Models

Models U-608 and U-1000—Ball Bearing

Models U-620B and U-1012B—Plain Bearing. 11/16" or 1/2" min. centers.

Models U-608BS and U-1000BS—Ball Bearing Gear Case. Plain Spindles.

Semi-Standard Heavy Duty Full Ball Bearing

1/2" in Cast Iron—7 1/8" or 9 3/4" Dia.

1/2" in Steel—7" or 9 5/8" Dia.

Also larger Adaptations and Full Line of Fixed Center Drill Heads.

* Standard Full Ball Bearing Construction including Spindles.

FULL BALL BEARING mounted with 3 Bearings on each spindle. Thrust load carried by radial thrust bearings.

* Standard-Slip-On and Slip-Off Template Construction.

For accurate setting and locating spindle brackets are machined to receive slip-on and slip-off template.

WRITE FOR FULL INFORMATION

THRIFTMASTER *Products Corporation*
A SUBSIDIARY OF THOMSON INDUSTRIES, INC.

Also Makers of DORMAN AUTOMATIC REVERSE TAPPERS

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BATEMAN BANTAM IRON WORKER

THE ONLY IRON WORKER OF ITS KIND ON THE MARKET TODAY

No Grinding Necessary After Cut. One Stroke Cycle Clutch Operator by Hand or Foot.

The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

Bateman Bantam with punch $575.00
Shear only $495.00
Shipping wt. 750 lbs.

WRITE TODAY for complete information and name of nearest distributor.

BATEMAN FOUNDRY & MACHINE
MINERAL WELLS, TEXAS

For more data circle Item 719 on Inquiry Card

SHOW THIS TO YOUR TOOLMAKER

Ask him if he doesn't agree that the Leland-Gifford No. 2LMS Toolroom Drill Press provides every feature and convenience needed in the modern toolroom for fast, accurate, effortless drilling and tapping. Developed in cooperation with leading tool engineers, this machine has won wide acceptance as the ideal drill press for general purpose toolroom use. Write for complete information.

LELAND-GIFFORD
No. 2LMS
TOOLROOM DRILL PRESS
with all these features:

1 Illuminated indicating shift with cutting speed chart.
2 Conveniently located hand wheel for changing spindle speeds without stopping machine . . . also for shifting back gears when furnished.
3 Positive stop for accurate depth adjustment.
4 Capacity of No. 2 Morse taper. No. 3 MT optional.
5 Extra large 37″ x 25″ or standard 26″ x 25″ work table.
6 26″ swing with 13″ overhang.
7 Handy push-back table raising crank and quick-acting table lock.
8 Foot switch start-stop motor control leaves operator's hand free.
9 Counterbalanced sliding head for effortless vertical adjustment.
10 Built-in light for table and work surface illumination.
11 Sensitive hand lever feed with ratchet adjustment, or . . .
12 Reversing motor control for tapping — provides manual control from feed lever or automatic control by depth stop (optional at small extra charge).

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2620 Leonis Blvd.
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INDIANAPOLIS 6, P. O. Box 1051
ROCHESTER 12, P. O. Box 24, Charlotte Station

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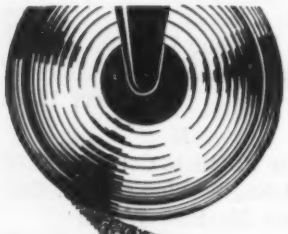

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Clean it fast *with* ROTOBLAST®

New high-capacity Rotoblast units throw up to 160,000 lbs. of abrasive an hour. To see how these units are incorporated in Pangborn machines for Rotoblasting castings, forgings, hot rolled steel, super alloys, etc., write PANGBORN CORP., 1200 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Blast Cleaning and Dust Control Equipment.*

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BLAST CLEANS CHEAPER

BARRELS • CONTINUOUS-FLO® BARRELS • TABLES • TURN-STYLE TABLES • ROOMS • TABLE-ROOMS • CABINETS • SPECIAL MACHINES

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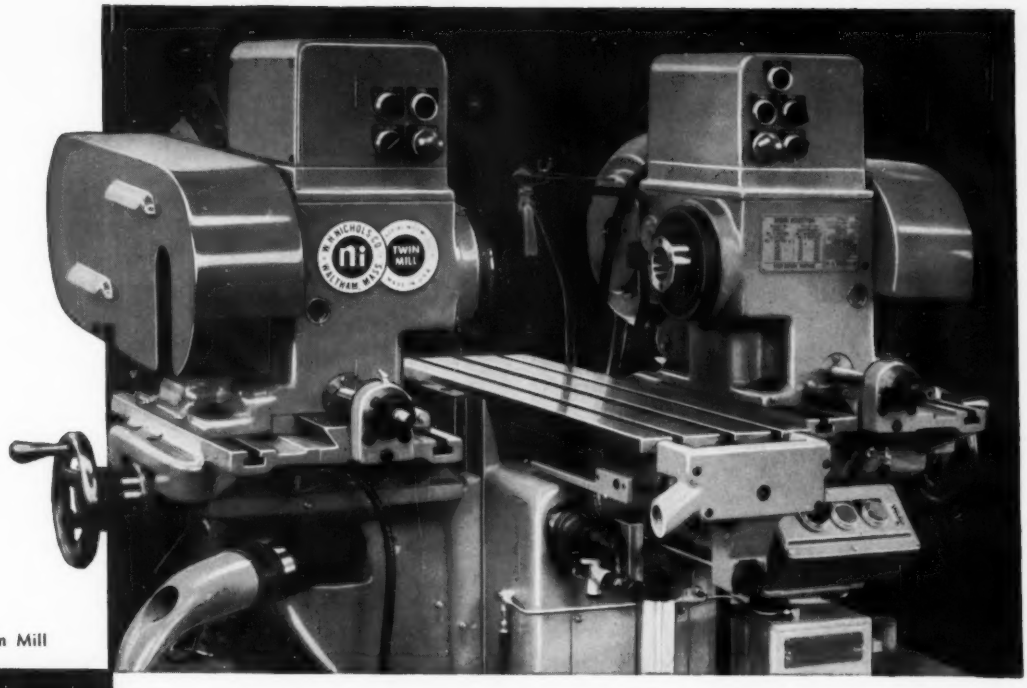
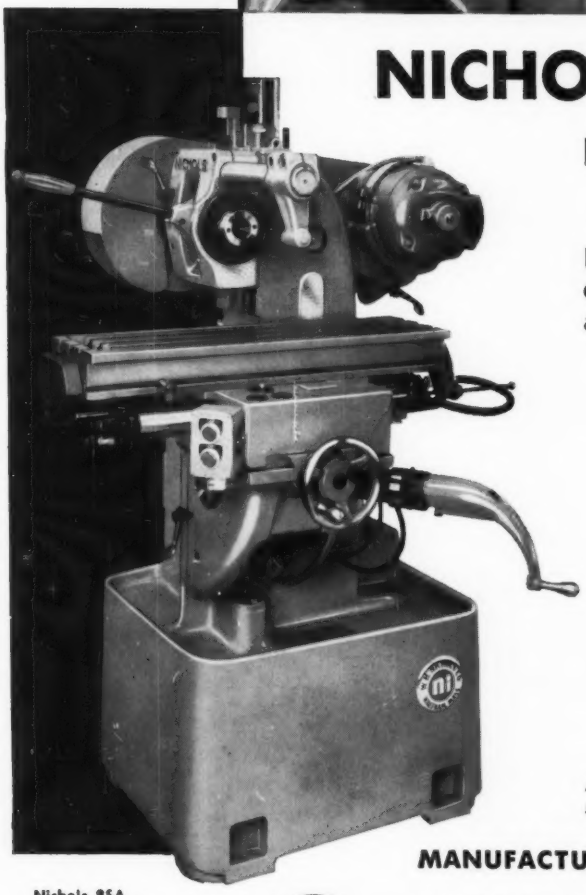


Twin Mill



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Semi-automatic

NICHOLS MILLERS . . .

Ideal Basic Machines for Automatic Production

NICHOLS MILLERS are versatile, work-devouring machine tools, unexcelled in accuracy and fine workmanship.

The TWIN MILL is practically TWO milling machines in ONE. Opposed Milling Heads have SIX-WAY adjustability for quick set-up and flexible approach to complex light milling operations. Push a button, and an automatic table cycle gives you TWO completed milling cuts. This unique duplex Miller is a cost-cutter without equal!

For high production precision milling where the double-barrelled approach of the TWIN MILL is not required, there are single spindle NICHOLS Semi-automatic Millers of varying work ranges. In addition to automatic table cycles, synchronized automatic down-feed of spindle head and automatic cross feeds are available.

NICHOLS MILLERS have a magnetic attraction for the Tool Engineer's ingenuity.

Write for literature and illustrations.

A NEW 16 mm. sound, color movie is available for free showing. May we reserve it for you?

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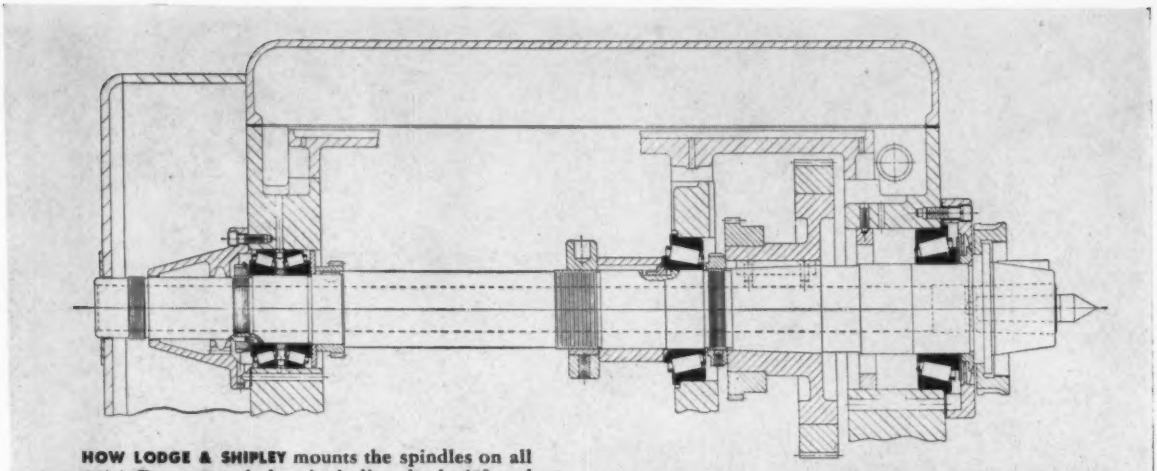

HOW LODGE & SHIPLEY mounts the spindles on all 2013 Powerturn lathes including both 45° and 90° Copymatics on Timken bearings to get extra rigidity, maintain accuracy, reduce maintenance.

New type lathe ups production 200%, saves users an estimated $8,000 a year

...one secret—TIMKEN® bearings on the spindle

"Production increases as high as 200%"..."Overall savings estimated at $8,000 a year"—read user reports about the new 2013 Powerturn 90° Copymatic Lathe. One important reason for such exceptional results is that Lodge & Shipley mounts the spindle on Timken® tapered roller bearings. Timken bearings give it the vital extra rigidity and hold runout to the minimum needed for tracer accuracy.

How spindle is held rigid. Timken bearings hold the spindle in positive alignment. They take *both* radial and thrust loads in any combination, because of their tapered design. And because of full line contact between rollers and races, Timken bearings have extra load-carrying capacity.

Why heavy shocks are absorbed. Case-carburization of Timken bearings' rollers and races gives them hard, wear-resistant surfaces and tough, shock-resistant cores.

How friction is virtually eliminated. Timken bearings are geometrically designed to roll true. And they're precision-made to live up to their design. They run smoother—last longer.

We even make our own electric furnace fine alloy steel, for extra quality control. We're America's only bearing maker that does. To get all these advantages, always specify bearings trade-marked "TIMKEN". The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN TAPERED ROLLER BEARINGS ROLL THE LOAD

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